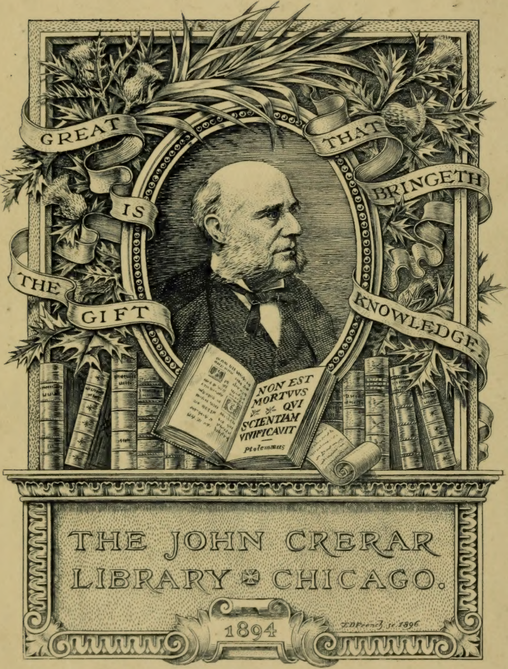

GREAT
IS
THE
GIFT
THAT
BRINGETH
KNOWLEDGE
NON EST MORTVVS QVI SCIENTIAM VIVIFICAVIT
Ptolemæus
THE JOHN CRERAR
LIBRARY ✠ CHICAGO.
1894
E.D.French sc. 1896

Monastery Hill Bindery

78.771
Oh 230

OLUME X UNIVERSITY BULLETIN SUPPLEMENT TO NO. 1

College of Engineering

of the

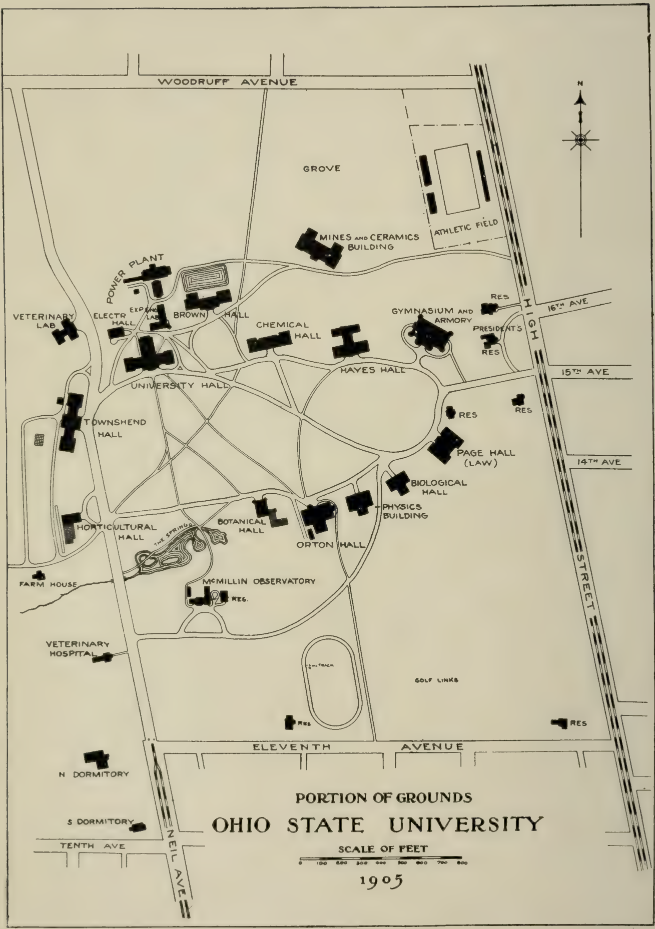
OHIO STATE UNIVERSITY

October, 1905

COLUMBUS
PUBLISHED MONTHLY BY THE UNIVERSITY

ENTERED AT THE POST OFFICE AT COLUMBUS, O., AS SECOND CLASS MATTER

THE
JOHN CRERAR
LIBRARY



PORTION OF GROUNDS

OHIO STATE UNIVERSITY

SCALE OF FEET

1905

Days and Dates

1905.

Entrance Examinations—8 A. M., Tuesday, Wednesday, Thursday and Friday, June 13, 14, 15 and 16.
Summer Courses in Surveying—June 16 to July 28.
Summer Courses in Shopwork—June 19 to July 15.
Summer Session (General Courses)—June 27 to August 4.

SUMMER VACATION.

Entrance Examinations—8 A. M., Tuesday, Wednesday, Thursday and Friday, September 12, 13, 14 and 15.
First Term Begins—Registration Day, Tuesday, September 19.
President's Annual Address—11 A. M., Friday, September 22.
Thanksgiving Recess—Thursday, Friday and Saturday, November 30, December 1 and 2.
Latest Date for Filing Thesis Subject—December 15.
First Term Ends—Wednesday December 20.

1906.

Second Term Begins—Registration Day, Tuesday, January 2.
Second Term Ends—Friday, March 30.

SPRING RECESS.

Third Term Begins—Registration Day, Wednesday, April 4.
Senior Class-work Ends—Saturday, May 26.
Latest Date for Presenting Thesis—Friday, June 8.
Final Examinations—Friday, June 8, to Thursday, June 14.
Latest Date for Filing Bound Copy of Thesis—Friday, June 15.
Baccalaureate Sermon—Sunday, June 17.
Class Day—Monday, June 18.
Alumni Day—Tuesday, June 19.
Commencement—Wednesday, June 20.
Entrance Examinations—8 A. M., Tuesday, Wednesday, Thursday and Friday, June 12, 13, 14 and 15.
Summer Courses in Surveying—Friday, June 15 to July 13.

378.771
Oh7L30
Withdrawn
134180

Summer Courses in Shop-work—Monday, June 18 to Saturday, July 14.

Summer session (General Courses)—Tuesday, July 26, to Friday, August 3.

SUMMER VACATION.

Entrance Examinations—8 A. M., Tuesday, Wednesday, Thursday and Friday, September 11, 12, 13 and 14.

Fall Term Opens—Registration Day, Tuesday, September 18.

Organization of the University

The Ohio State University, located in Columbus two miles north of the Union Station, is a part of the public educational facilities maintained by the State. It comprises six colleges:

The College of Agriculture and Domestic Science.
The College of Arts, Philosophy and Science.
The College of Engineering.
The College of Law.
The College of Pharmacy.
The College of Veterinary Medicine.

This Bulletin of Announcements is devoted exclusively to the work of the College of Engineering.

Corps of Instruction

REV. WILLIAM OXLEY THOMPSON, D. D. LL. D....University Grounds
President of the University.

EDWARD ORTON, JR., E. M. DEAN........................The Normandie
Professor and Director of the Department of Clayworking and Ceramics.

NATHANIEL WRIGHT LORD, E. M............338 West Eighth Avenue
Professor of Metallurgy and Mineralogy and Director of the School of Mines.

SIDNEY AUGUSTUS NORTON, Ph. D., LL. D......363 East Town Street
Emeritus Professor and Lecturer in General Chemistry.

STILLMAN W. ROBINSON, C. E., D. Sc............1353 Highland Street
Emeritus Professor of Mechanical Engineering.

BENJAMIN FRANKLIN THOMAS, Ph. D.............University Grounds
Professor of Physics.

GEORGE WELLS KNIGHT, Ph. D....................85 Jefferson Avenue
Professor of American History and Political Science.

ROSSER DANIEL BOHANNAN, B. Sc., C. E., E. M..............
.................................Sixteenth and Indianola Avenues
Professor of Mathematics.

BENJAMIN LESTER BOWEN, Ph. D..............775 East Broad Street
Professor of the Romance Languages and Literatures.

JOSEPH VILLIERS DENNEY, B. A..............230 West Tenth Avenue
Professor of English.

WILLIAM THOMAS MAGRUDER, M. E................191 King Avenue
Professor of Mechanical Engineering.

WILLIAM McPHERSON, JR., D. Sc., Ph. D............University Grounds
Professor of Chemistry.

JOSEPH NELSON BRADFORD, M. E..............54 West Tenth Avenue
Professor of Architecture and Drawing.

HENRY CURWEN LORD, B. Sc.......................University Grounds
Professor of Astronomy and Director of the Emerson McMillin Observatory.

FRANK EDWIN SANBORN, S. B., SECRETARY......303 West Eighth Avenue
Professor and Director of the Department of Industrial Arts.

FRANK ARNOLD RAY, E. M..........................137 King Avenue
Professor of Mine Engineering.

GEORGE L. CONVERSE, Captain U. S. A. (Retired)....94 Hoffman Avenue
Professor of Military Science and Tactics.

EMBURY ASBURY HITCHCOCK, M. E..........380 West Eighth Avenue
Professor of Experimental Engineering.

FRANCIS CARY CALDWELL, B. A., M. E..........401 West Sixth Avenue
Professor of Electrical Engineering.

CHARLES SMITH PROSSER, M. S..............114 West Tenth Avenue
Professor of Geology.

JOHN ADAMS BOWNOCKER, D. Sc...................1594 Neil Avenue
Professor of Inorganic Geology and Curator of the Museum.

ALFRED DODGE COLE, A. M..................237 West Eleventh Avenue
Professor of Physics.

CHRISTOPHER ELIAS SHERMAN, C. E..................772 Oak Street
Professor of Civil Engineering.

ALBERT HENRY HELLER, C. E......................1249 Neil Avenue
Professor of Structural Engineering.

DAVID R. MAJOR, Ph. D.............................387 King Avenue
Professor of Education.

JAMES EDWARD HAGERTY, Ph. D...............212 West Tenth Avenue
Professor of Economics and Sociology.

FRANK HARVEY ENO, B. Sc., C. E..............251 West Ninth Avenue
Professor of Municipal Engineering.

OLIVE B. JONES..............................95 West Eleventh Avenue
Librarian.

GEORGE WASHINGTON McCORD, M. A..........244 West Tenth Avenue
Associate Professor of Mathematics.

JAMES ELLSWORTH BOYD, M. S.............60 West Maynard Avenue
Associate Professor of Mathematics.

CHARLES A. BRUCE, B. A.....................235 West Tenth Avenue
Associate Professor of the Romance Languages and Literatures.

WILLIAM EDWARD HENDERSON, Ph. D........182 West Tenth Avenue
Associate Professor of Chemistry.

THOMAS EWING FRENCH, M. E................1458 Worthington Street
Associate Professor of Architecture and Drawing.

CHARLES WILLIAM FOULK, B. A....................1656 Neil Avenue
Associate Professor of Chemistry.

MATTHEW BROWN HAMMOND...............39 East Eleventh Avenue
Associate Professor of Economics and Sociology.

G. A. ANDEREGG, A. M..............................————————
Associate Professor of Electrical Engineering.

WILLIAM LUCIUS GRAVES, M. A................1313 Forsythe Avenue
Assistant Professor of English.

CHARLES LINCOLN ARNOLD, M. Sc............328 West Eighth Avenue
Assistant Professor of Mathematics.

KARL DALE SWARTZEL, B. Sc................308 West Eighth Avenue
Assistant Professor of Mathematics.

GEORGE H. McKNIGHT, Ph. D....................269 East Broad Street
Assistant Professor of English.

WILLIAM ABNER KNIGHT, M. E................206 West Lane Avenue
Assistant Professor of Machine-Shop Practice.

FREDERICK KESTER, M. E. in E. E....................——————
Assistant Professor of Physics.

HARRY WALDO KUHN, B. Sc..................308 West Eighth Avenue
Assistant Professor of Mathematics.

ALONZO HULBERT TUTTLE, B. A................215 West Tenth Avenue
Assistant Professor of American History and Political Science.

HORACE JUDD, M. E.; M. Sc....................245 West Fourth Avenue
Assistant Professor of Experimental Engineering.

EDWIN F. CODDINGTON, Ph. D...............39 West Eleventh Avenue
Assistant Professor of Mathematics.

EDGAR S. INGRAHAM, Ph. D..................303 West Seventh Avenue
Assistant Professor of Romance Languages.

ROBERT F. EARHART, Ph. D.........................1656 Neil Avenue
Assistant Professor of Physics.

THOMAS KENYON LEWIS ....96 East Eighth Avenue
Assistant Professor of Architecture and Drawing.

*JOSEPH HENRY VOSSKUEHLER, M. E..................——————
Assistant Professor of Architecture and Drawing.

GEORGE B. VILES, Ph. D.....................229 West Eleventh Avenue
Assistant Professor of Germanic Languages and Literatures.

*H. DIETRICH BRUNING, C. E..........................768 Oak Street
Assistant Professor of Civil Engineering.

ALLAN COGGESHALL ....——————
Assistant Professor of Electrical Engineering.

EDWARD EVERETT SOMERMEIER, G. Ph.............1590 Neil Avenue
Assistant Professor of Metallurgy and Mineralogy.

HENRY RUSSELL SPENCER, M. A....................1473 Neil Avenue
Assistant Professor of American History and Political Science.

---

* Resigned.

ROY STEVENSON KING, M. E.......................——————
Assistant Professor of Mechanical Engineering.

WILLIAM LLOYD EVANS, M. Sc.......................——————
Assistant Professor of Chemistry.

ALBERT VICTOR BLEININGER, B. Sc............422 West Sixth Avenue
Assistant Professor of Clay Working and Ceramics.

GEORGE D. HUBBARD, Ph. D.........................——————
Assistant Professor of Geology.

F. A. McKENZIE, Ph. D..............................——————
Assistant Professor of Economics and Sociology.

CARSON S. DUNCAN, M. S.............................——————
Assistant Professor of English.

WILLIAM HENRY RENCK ....180 West Frambes Avenue
Instructor in Pattern-Making and Founding.

CHARLES PHILIP CROWE.........................1453 Wesley Avenue
Instructor in Forging.

SILAS MARTIN ....317 Fifteenth Avenue
Instructor in Drawing.

SAMUEL EUGENE RASOR, B. Sc.....................1594 Neil Avenue
Instructor in Mathematics.

BERTHOLD AUGUST EISENLOHR, Ph. D........1627 North High Street
Instructor in German.

DON CARLOS HUDDLESON, M. D.................326 Linwood Avenue
Instructor in Physical Education for Men.

JOHN SATTERLEE TIDBALL, B. S............88 East Eleventh Avenue
Instructor in Drawing.

*RUDOLPH HIRSCH, B. Sc.....................1060 South Front Street
Instructor in Chemistry.

KATHERINE EMILY ANDREWS, M. A..........1013 East Broad Street
Instructor in Chemistry.

RALPH ROGERS ....129 West Tenth Avenue
Instructor in Architecture and Drawing.

HIRAM DOUTHITT AYRES, M. A................192 West Eighth Avenue
Instructor in Physics.

—————— .... ——————
Instructor in Architecture and Drawing.

MAY THOMAS, Ph. D.................................——————
Instructor in German.

MARY E. HASKELL, M. A.............................——————
Instructor in Romance Languages.

---

* Resigned.

J. WARREN SMITH, M. Sc..............................1422 Oak Street
Lecturer on Meteorology.

BENJAMIN FRANKLIN MAAG, B. Ph., M. Sc.....176 West Ninth Avenue
Assistant in Astronomy.

ROSS C. PURDY ....112 West Lane Avenue
Assistant in Clayworking and Ceramics.

HOWARD R. WATKINS.............................1603 Hunter Street
Assistant in Chemistry.

CLINTON G. STEWART...............................1287 Bryden Road
Assistant in Chemistry.

JOHN ROSS CHAMBERLIN.....................226 West Ninth Avenue
Assistant in Civil Engineering.

DANA JAMES DEMOREST.....................93 West Eleventh Avenue
Assistant in Metallurgy and Mineralogy.

KENNETH BAKER WARD, C. E....................1430 Highland Street
Assistant in Civil Engineering.

CLARENCE CHARLES VOGT...................131 West Eighth Avenue
Assistant in Chemistry.

LLOYD CLARK HOPKINS, M. E.....................——————
Assistant in Mechanical Engineering.

JOHN McBRIDE KNOTE........................307 West Ninth Avenue
Fellow in Chemistry.

MIMA J. WEAVER..............................61 West Tenth Avenue
Fellow in English.

GERTRUDE SEE JACKSON...................89 North Twentieth Street
Fellow in Romance Languages.

WILLIAM FRANKLIN GEPHART, B. A.................——————
Fellow in Economics and Sociology.

—————— .... ——————
Fellow in Electrical Engineering.

CARL RIGDON, M. E.................................——————
Fellow in Experimental Engineering.

HARRY G. BROWN, B. A..............................——————
Fellow in English.

W. R. GOODRICH ....——————
Fellow in Germanic Languages and Literatures.

HERBERT M. HUGHES, B. A..........................——————
Fellow in Germanic Languages and Literatures.

PAUL G. MOORE, B. A.................................——————
Fellow in Chemistry.

—————— .... ——————
Fellow in Mathematics.

—————— .... ——————
Fellow in Mathematics.

T. B. SIMON ....114 West Ninth Avenue
Student Assistant in Mine Engineering.

ALBERT B. WELTY ....202 West Eighth Avenue
Student Assistant in Industrial Arts.

CHARLES EDGAR BLIVEN..............................——————
Student Assistant in Woodworking.

—————— .... ——————
Student Assistant in Architecture and Drawing.

—————— .... ——————
Student Assistant in Metallurgy and Mineralogy.

—————— .... ——————
Student Assistant in Mine Engineering.

ALBERT FREEMAN HALL..........................1051 Highland Street
Machinist, Department of Mechanical Engineering.

JOHN PATTERSON COVAN......................164 West Ninth Avenue
Machinist, Department of Electrical Engineering.

ALLANDO CASE ....183 West Frambes Avenue
Machinist, Department of Industrial Arts.

CLEMENT N. BEEM ....309 West Third Avenue
Patternmaker, Department of Industrial Arts.

CARL LAFAYETTE KNOPF, M. E. in E. E...............——————
Second Machinist, Department of Electrical Engineering.

College of Engineering

The purpose of the College of Engineering is to thoroughly ground students in the fundamental sciences and arts upon which all Engineering rests; to impart such special and technical knowledge of the various branches of engineering as is practicable in the time available; and finally, by the severe scholastic discipline of this training, together with collateral work in Language and Literature, to impart an appreciation of the pleasures of culture and scholarship, and a recognition of the civic duties and moral responsibilities which in modern society fall upon every educated man.

In the attainment of these inseparable ends, the work of the College of Engineering is directed, first, to the mastery of the principles of Mathematics, Physics and Chemistry by means of theoretical courses; second, by laboratory work in these and related sciences and in the graphic arts, to fix principles firmly in the mind of the student and develop his power to apply them to concrete cases; third, to give such opportunity for specialization in the various fields and departments of Engineering as its constantly increasing scope and subdivision renders possible. Added to these technical subjects, instruction is given in the use of English, developing the power to write clear and concise reports, and in at least one foreign language sufficient to bring the technical literature of that language within grasp.

It is recognized that the graduate of any Engineering school can have at best but a meagre equipment in the actual knowledge of Engineering, and that he must inevitably be largely lacking in the experience and mature judgment which the competent engineer brings to his work. But he can at least gain at school a good foundation for accurate reasoning and sound judgment, and it is believed that these qualities are developed in higher degree by such carefully prescribed courses as are here offered, than in partially or wholly elective courses.

The great expansion in technical education witnessed in the last two decades has been due to two causes, first, the rapid growth of the manufacturing industries and of the great public works by which their products are distributed, and second, by the constantly increasing conviction in the minds of manufacturers and administrators that the capable, self-reliant and trustworthy men whom they need are produced in fuller degree by the rigid training of an Engineering school than by any other means.

Courses Offered

This college offers instruction in nine important fields of Engineering work. Covering these the following four-year courses of study are offered:

1. Architecture, leading to the degree of Civil Engineer in Architecture (C. E. in Arch.).
2. Ceramics, leading to the degree of Engineer of Mines in Ceramics (E. M. in Cer.).
3. Chemical Engineering, leading to the degree of Bachelor of Science in Chemical Engineering (B. Sc.).
4. Civil Engineering, leading to the degree of Civil Engineer (C. E.).
5. Electrical Engineering, leading to the degree of Mechanical Engineer in Electrical Engineering (M. E. in E. E.).
6. Industrial Arts, leading to the degree of Bachelor of Science in Industrial Arts (B. Sc.).
7. Manual Training, leading to the degree of Bachelor of Bachelor of Science in Industrial Arts (B. Sc.).
8. Mechanical Engineering, leading to the degree of Mechanical Engineer (M. E.).
9. Mining Engineering, leading to the degree of Engineer of Mines (E. M.).

The following two-year, or short courses, do not lead to a degree, but students completing them are furnished a formal certificate stating the work they have accomplished:

10. Clay-working.
11. Industrial Arts and Shopwork.
12. Mining.

The necessary instruction for these courses of study is given in twenty-one different departments under ninety-eight professors and assistants. In some of these courses there is opportunity for elective work, which may be selected from any of the thirty-seven departments of the University. The library of about 50,000 volumes includes the most important treatises in the different fields of Engineering.

Admission

Applicants for admission to the College of Engineering must be at least 17 years of age. They must be provided with testimonials of good moral character from their last instructor. If they have previously attended any other college or university, they must present a letter of honorable dismissal therefrom.

Modes of Admission

There are two modes of admission to the College of Engineering —by examination and by certificate.

Entrance Examinations

The entrance examinations for 1905 will be held on Tuesday, Wednesday, Thursday and Friday, June 13, 14, 15 and 16, and on Tuesday, Wednesday, Thursday and Friday, September 12, 13, 14 and 15.

A part of the examinations may be taken in June and the remainder in September, or all may be taken at either period. *All applicants for admission who are not graduates of accredited or recognized schools must take examinations for admission. Also, applicants, graduates of accredited or recognized schools, must pass examinations in those subjects which are necessary to admission to this College, and which are not covered by their certificates.*

Certificates

Applicants for admission may be admitted on presentation of properly indorsed certificates from secondary schools which have been accredited or recognized by the University.

Certificates must contain a detailed statement of the studies pursued, the text books used, the amount of work done in each study, the amount of time devoted to it and the applicant's rank or standing. Blank forms for such certificates will be furnished on application. Address, Entrance Board, Ohio State University, Columbus.

Only graduates of the schools in the following lists and of the classes stated will be given entrance credit for those studies required for admission which are covered by said certificates. *Examinations will be necessary in those subjects for entrance which are not thus covered.* Any graduate of a previous year, planning to enter the College of Engineering, should write the University for information concerning acceptance of his certificate. Non-graduates will be admitted by examination only.

Also, where certificates of credits issued by the National College Examination Board are presented, they will be accepted, and also where certificates are presented from Normal Schools, academies and private preparatory schools not in Ohio, technical schools and preparatory departments of other Colleges, schools in foreign countries, and secondary and technical schools in other states, where inspection is not practicable but where good reason exists for believing that the work offered is of acceptable grade, the Entrance Board may at its discretion accept such certificates for part or all of the requirements, provided that if the work of the applicant subsequently fails to justify this act, the credits may be revoked in part or in whole.

List of Accredited and Recognized Schools in Ohio

These lists are subject to change from year to year as schools are revised. Persons are advised therefore to consult the latest bulletin.

- Alliance R.
- Akron A.
- Ashland A.
- Ashtabula A.
- Athens R.
- Baltimore R.
- Barnesville A.
- Batavia R.
- Bedford R.
- Bellaire R.
- Bellefontaine A.
- Bellevue R.
- Bethel Township, Miami Co. R.
- Bryan A.
- Bucyrus A.
- Caldwell R.
- Cambridge A.
- Canal Dover R.
- Canal Winchester R.
- Canton A.
- Carey R.
- Celina R.
- Chagrin Falls R.
- Chardon A.
- Chillicothe A.
- Cincinnati—
  - Hughes A.
  - Walnut Hills A.
  - Woodward A.
- Cincinnati Technical School A.
- Circleville A.
- Cleveland—
  - Central A.
  - East A.
  - Lincoln A.
  - South A.
  - West A.
- Clintonville R.
- Clyde A.
- Collinwood A.
- Columbus—
  - Central A.
  - East A.
  - North A.
  - South A.
  - Columbus School for Girls A.
- Columbus Grove R.
- Conneaut R.
- Corning R.
- Coshocton A.
- Cuyahoga Falls R.
- Dayton A.
- Delaware A.
- DeGraff R.
- Dennison R.
- East Cleveland A.
- East Liverpool A.
- Elyria A.
- Euclid R.

Findlay A.
Fort Recovery R.
Fostoria A.
Fremont A.
Friends' Boarding School (Barnesville) R.
Galion A.
Gallipolis A.
Garrettsville R.
Georgetown A.
Germantown R.
Glendale A.
Glenville A.
Gnadenhutten R.
Grand River Institute A.
Granville R.
Greenfield A.
Greenville A.
Groveport R.
Hamilton A.
Harmony Township (Clark County) R.
Hillsboro A.
Ironton A.
Jackson A.
Jefferson A.
Kenton A.
Kingsville A.
Kirtland R.
Lakeside A.
Lakewood A.
Lancaster A.
Lebanon R.
Leipsic R.
Lima A.
Lockland A.
Logan A.
London A.
Lorain R.
Madison R.
Madisonville A.
Mad River Township (Enon Village) R.
Mansfield A.
Marietta A.
Marion A.
Martins Ferry A.
Marysville A.
Massillon R.
Medina A.
Mechanicsburg A.
Miamisburg A.
Middletown A.
Mt. Sterling R.
Mt. Vernon A.
Napoleon R.
Nelsonville A.
Newark A.
New Bremen R.
New Lexington R.
New London A.
New Lyme Institute A.
New Philadelphia A.
New Vienna R.
Niles R.
North Baltimore R.
Norwalk A.
Norwood R.
Oak Harbor R.
Oberlin R.
Oberlin Academy A.
Olive Branch R.
Orrville R.
Osborne R.
Ottawa R.
O. S. & S. O. Home R.
Painesville A.
Pandora R.
Pataskala R.
Perrysburg R.
Piqua A.
Plain City R.
Pleasant Ridge R.
Pomeroy R.
Port Clinton R.
Portsmouth A.

Quaker City R.
Ravenna R.
Reynoldsburg R.
Richwood R.
Riley Township (Putnam County) R.
Ripley R.
Salem A.
Sandusky A.
Shelby R.
Sidney A.
Solon R.
Somerset R.
South Charleston R.
Spencerville R.
Springfield A.
Steubenville A.
St. Marys A.
St. Paris R.
Tiffin A.
Tippecanoe City R.
Toledo A.
Troy A.
Uhrichsville R.
Urbana A.
Upper Sandusky R.
Van Wert A.
Wapakoneta R.
Warren A.
Washington C. H. A.
Wauseon R.
Wellington A.
Wellston A.
Wellsville A.
Willoughby A.
Woodsfield R.
Wooster A.
Worthington R.
Wyoming A.
Xenia A.
Youngstown A.
Zanesville A.

Accredited Schools of Other States.

Michigan. Albion; Ann Arbor; Alpena; Adrian; Benton Harbor Collegiate Institute; Battle Creek; Bay City; Charlotte; Bessemer; Calumet; Coldwater; Detroit—Western, Eastern, Central, Home and Day, Detroit University; Delray; Escanaba; Ferris Institute; Flint; Grand Rapids Central; Hancock; Ionia; Ishpeming; Iron Mountain; Jackson; Kalamazoo; Lansing; Lake Linden; Ludington; Marshall; Manistee; Menominee; Michigan Seminary (Kalamazoo); Muskegon; Michigan Military Academy (Orchard Lake); Mt. Clemens; Marquette; Negaunee; Norway; Owosso; Port Huron; Niles; Pontiac; Petoskey; Sault Ste. Marie; Saginaw—West Side, East Side; St. Joseph; Traverse City; West Bay City; Ypsilanti.

Indiana. Elkhart City; Fort Wayne; Howe Military School; LaPorte; Michigan City; Richmond; South Bend; Shortridge and Manual Training, Indianapolis.

Illinois. Aurora (East); Aurora (West); Bloomington; Chicago—Austin, Calumet, Englewood, Hyde Park, Jefferson, John Marshall, Joseph Medill, Lake, Lake View, North West Division, Richard T. Crane, Manual Training, Robert A. Waller, South Chicago, Wendell Phillips, William McKinley; Decatur; De Kalb Tp.; Dixon; Elgin; Evanston Tp.; J. Sterling Norton Tp.; Joliet Tp.; La Salle, Peru Tp.; Lyons Tp. (La Grange); Moline; Oak Park Tp.; Ottawa Tp.; Peoria; Pontiac Tp.; Princeton; Rockford; Rock Island; Sterling Tp.; Thornton Tp. (Harvey).

Iowa. Boone; Burlington; Capital Park; Cedar Rapids; Charles City; Clinton; Corning; Council Bluffs; Davenport; Des Moines—East, North, West; Fort Dodge; Grinnell; Iowa City; Le Mars; Mason City; Muscatine; Ottumwa; Sheldon; Sioux City.

Wisconsin. Appleton; Ashland; Baraboo; Wayland Academy; Beaver Dam; Beloit; Berlin; Chippewa Falls; Eau Claire; Fond du Lac; Grand Rapids; Janesville; La Crosse; Madison; Marinette; Marshfield; Menominee; Milwaukee—East Division, West Division, South Division, Milwaukee Downer Seminary; New Richmond; Oshkosh; Portage; Racine; Ripon; Sheboygan; Sparta; Stevens Point; Superior, Blaine, Dewey; Waukesha; Whitewater.

Minnesota...Duluth; Minneapolis—Central, East Side, North Side, South Side; Redwing; St. Paul—Central, Cleveland, Humboldt; Winona.

Missouri. Columbia; Kansas City Central, Kansas City Manual Training; Trenton; St. Louis—McKinley, St. Louis Central.

Colorado. Canon City; Cripple Creek; Denver, West Side; Durango; Fort Collins; Golden, Grand Junction; Greely; La Junta; Leadville; Pueblo, Central; Pueblo, District No. 1; Trinidad; Victor.

South Dakota. Yankton.

Correspondence Concerning Admission

The admission of students into all Colleges of the Ohio State University is largely in the hands of the Entrance Board, who conduct examinations, receive and pass upon certificates and give all necessary information to applicants. All correspondence should be addressed to this Board. The Board will give the applicant an entrance card, showing the number and nature of the credits allowed, and this card will be good toward entrance to any college in the University, up to the face value of the number of units granted.

Requirements for Admission to the Four-Year Courses in the College of Engineering

Applicants to be admitted to full standing in the College of Engineering must obtain from the Entrance Board credit for thirteen units from the list below, subject to the restrictions printed in the list. Applicants slightly in arrears may be admitted to Freshman work, subject to certain entrance conditions as set forth later. The extent and character of the work required for credit in each subject mentioned in this list will be found immediately following the tabular statement.

English

Group A.

Two units chosen from the following:

(1)	English Composition and Rhetoric	1 unit
(2)	English Classics	1 unit
(3)	English Literature	1 unit

History

Group B.

Two units chosen from the following:

(4)	Civil Government	½ unit
(5)	United States History	½ unit or 1 unit
(6)	General History	½ unit or 1 unit
(7)	Greek and Roman History	½ unit
(8)	English History	½ unit

Mathematics

Group C.

Three units as follows. No conditions are permitted in Mathematics:

(9)	Algebra (through quadratics)	1 unit
(10)	Algebra (beyond quadratics)	½ unit
(11)	Geometry (plane)	1 unit
(12)	Geometry (solid and spherical)	½ unit

Science

Group D.

Two units chosen from the following, including Physics:

(13)	Physics	1 unit
(14)	Physical Geography	½ unit
(15)	Botany	½ unit
(16)	Chemistry	1 unit
(17)	Physiology	½ unit
(18)	Zoology	½ unit
(19)	Geology	½ unit
(20)	Astronomy	½ unit

Foreign Language

Group E.

Four units chosen from the following, or two units from this group, together with two extra units from Groups A, B and D.

(21)	Latin (Grammar Elementary Reader, and Prose Composition)	1 unit
(22)	Latin (Caesar, I, II, II, IV)	1 unit
(23)	Latin (Cicero, I, II, III, IV, V, VI)	1 unit
(24)	Latin (Virgil, I, II, III, IV, V, VI)	1 unit
(25)	Greek (Grammar, Elementary Reader and Prose Composition)	1 unit
(26)	Greek (Xenophon's Anabasis, I, II, III)	1 unit
(27)	Greek (Anabasis, IV, V, VI, Homer and other texts)	1 to 3 units
(28)	German (Grammar, Elementary Reader and Prose Composition)	1 unit
(29)	German (Texts)	1 to 3 units
(30)	French (Grammar, Elementary Reader and Prose Composition)	1 unit
(31)	French (Texts)	1 to 3 units
(32)	Spanish (Grammar, Elementary Reader and Prose Composition)	1 unit
(33)	Spanish (Texts)	1 to 3 units

A modern language is preferred, but Latin and Greek will be accepted. Those entering college with Latin or Greek will be required to begin a modern language in the first year of their course. Those entering with a modern language will be required to continue the same language in their first year.

Extent and Character of Subjects for Entrance

GROUP A—ENGLISH.

Two units are required.

(1) English Composition and Rhetoric. One unit. Each applicant will be tested as to his ability to write clear and correct English. The test will be the writing of several brief essays, of which one will be upon a subject drawn from the applicant's observation or experience, and the others upon topics requiring a knowledge of the books in the (2) English Classics. The amount and kind of work required is indicated in Scott and Denney's Composition-Rhetoric.

(2) English Classics. One unit. The following books, or *equivalents,* should be read with sufficient care to insure a knowledge of their story-plot, or argument, their chief incidents, and their principal characters: Shakespeare's *Merchant of Venice, Julius Caesar,* and *Macbeth;* Milton's *Lycidas, Comus, L'Allegro,* and *Il Penseroso;* Burke's *Conciliation with the Colonies;* Macaulay's *Essays on Milton and Addison;* The Sir Roger de Coverly Papers in *The Spectator;* Goldsmiths' *The Vicar of Wakefield;* Coleridge's *The Ancient Mariner;* Scott's *Ivanhoe;* Carlyle's *Essay on Burns;* Tennyson's *The Princess;* Lowell's *The Vision of Sir Launfal;* George Eliot's *Silas Marner.*

(3) English Literature. One unit. Scudder's English Literature, Johnson's History of English and American Literature or the Introductions by Pancoast, Painter, Halleck, or Newcomer; together with the reading of representative works of literature.

GROUP B—HISTORY.

Two units are required.

(4) Civil Government. One-half unit. Fiske's Civil Government, or equivalent. No credit on certificate given for this when studied incidentally to U. S. History.

(5) United States History. One-half unit or one unit. Johnson's High School History of the United States, McLaughlin's History of the American Nation, Montgomery's Students' American History, or equivalent. No credit given on certificate for work below the ninth grade.

(6) General History. One-half unit or one unit. Adams's European History, Myers' General History, or equivalent.

(7) Greek and Roman History. One-half unit. Botsford's History of Greece and History of Rome, or equivalent.

(8) English History. One-half unit. Montgomery's Leading Facts of English History, or equivalent.

GROUP C—MATHEMATICS.

Three units are required. No conditions allowed.

Algebra. One and one-half units. Taylor's "Elements of Algebra" or an equivalent.

(9) One unit. Special attention should be given to the four fundamental operations, linear equations (single and in systems), factoring, highest common factor, lowest common multiple, fractions, and fractional equations, involution, evolution, surds and complex quantities; quadratic equations solved by factoring, by completing the square, and by the general formula.

(10) One-half unit. A thorough review of the work of the first unit, irrational equations, simultaneous quadratic equations, higher equations solvable by factoring, ratio, proportion, progressions, theory of exponents, binominal theorem for positive integral exponents and the use of five-place tables of logarithms.

Geometry. One and one-half units. Venable's, Wells', Wentworth's, White's, Beman and Smith's, or equivalent.

(11) One unit. Plane Geometry with solution of originals.

(12) One-half unit. Solid and Spherical Geometry with solution of originals.

The student in an engineering course is badly crippled unless he can use his mathematics with confidence, accuracy and rapidity. He should be able to perform any operation and solve any ordinary problem in the above list of subjects and determine the correctness of his results. This skill can only be acquired by practice.

The student intending to enter the Engineering College is advised to review his Algebra, making it a point of honor to solve every exercise in the text book used. If his high school work has been well done, and if he possesses the mathematical ability, together with that self-reliance and determination without which he cannot succeed as an engineer, he should be able to make this review with little or no assistance.

GROUP D—SCIENCE.

Two units are required, including Physics. If Physics is not offered as an entrance credit, it must be made good before the student can enter his Sophomore work.

(13) Physics. One unit. Carhart and Chute, Gage, Avery or an equivalent.

(14) Physical Geography. One-half unit. Geikie's Elementary Lessons or its equivalent.

(15) Botany. One-half unit. Kellerman's Elementary Botany and Spring Flora, or equivalent.

(16) Chemistry. One unit. Remsen's Introduction to the Study of Chemistry or equivalent. For laboratory work, McPherson's Laboratory Exercises, arranged to accompany Remsen's Chemistry, or equivalent.

(17) Physiology. One-half unit. Martin's Human Body (brief course) or equivalent. No credit given on certificate for work done below the ninth grade.

(18) Zoology. One-half unit. Jordan and Kellogg's "Animal Life;" Kellogg's "Elementary Zoology;" Davenport's "Introduction;" or equivalent, with laboratory work or field work.

(19) Geology. One-half unit. Brigham's, Dana and Rice's (revised), Tarr's or Le-Conte's, or equivalent, supplemented by study of the geological phenomena and formations found in the vicinity of the school.

(20) Astronomy. One-half unit. Young's Lessons in Astronomy, Comstock's Text-Book of Astronomy, or equivalent.

GROUP E—*FOREIGN LANGUAGE.

Four units are required, or two units together with two extra units from Group A, B and D.

(21) Latin. One unit. Grammar, Elementary Reader, and Prose Composition. The Roman method of pronunciation. An exact knowledge of the inflections is essential.

(22) One unit. Caesar. Four books of De Bello Gallico.

(23) One unit. Cicero. Six Orations, including Pro Lege Manilia.

(24) One unit. Virgil. Six books of the Aeneid, with prosody, prose composition Daniel, Collar, Jones, or Dodge and Tuttle.

(25) Greek. One unit. Grammar (Goodwin's preferred) and prose composition, or the first one hundred lessons in White's Beginner's Greek Book.

(26) One unit. Xenophon. Anabasis, Books I, II and III.

(27) One to three units. Xenophon. Anabasis, Books IV, V and VI. Homer, Iliad, Books I, II and III, and additional texts.

(28) German. One unit. Grammar, pronunciation, prose composition and Elementary Reader.

(29) One to three units. Easy German Literature, Prose, Ballads, Lyrics, Sight Reading, Advanced Prose Composition, Oral Exercises.

(30) French. One unit. Grammar, Pronunciation, Prose Composition, Elementary Reader.

(31) One to three units. Modern Prose Reading, Advanced Prose Composition, Sight Reading, French of the Seventeenth Century and later; writing short essays in French, Conversation.

(32) Spanish. One unit. Grammar, Pronunciation, Prose Composition and Elementary Reader.

(33) One to three units. Modern Spanish texts, advanced prose composition, sight reading of difficult prose and poetry, writing short essays in Spanish, Conversation.

---

* A knowledge of at least one language other than English is required for admission. Students preparing for an Engineering Course are advised to take as early an opportunity as possible to begin the study of a modern language.

Entrance Conditions

No applicant under twenty-one years of age will be admitted to the four-year courses of the College of Engineering who is in arrears more than one unit in entrance requirements; i. e., he must have twelve out of the thirteen units rquired. No deficiencies are allowed in Mathematics, and while the applicant may be deficient in Physics at the time of his entrance, it must be made good before his entrance requirements are finally satisfied. An applicant twenty-one years of age or over who is deficient in foreign language training will be admitted with this deficiency in addition to the one unit permitted above; i. e., he may enter with a minimum of ten out of the thirteen units required.

Removal of Entrance Conditions

All entrance conditions must be removed by examination under University officers before the beginning of the third year, except that Physics must be removed before the beginning of the second year. Certificates will not be received for entrance conditions after matriculation.

For those who have conditions in foreign language to remove, the following special arrangements will be made:

1. Those entering with a partial credit in Latin or Greek may make good their deficiency by doing an equivalent amount of work in a modern language in the college. For this work they will receive no college credit.

2. Those twenty-one years of age or over, entering with no training in language, may make good their deficiency by beginning a modern language in the college. For this work they will receive no college credit.

Requirements for Admission to the Short Courses

Applicants must not be less than seventeen years of age, and, unless they are over twenty-one years of age, must pass examinations in Arithmetic and Geography, and must be able to write a business letter or a short theme correct in Grammar and Orthography; or they must present satisfactory certificates showing that they have successfully pursued these subjects elsewhere. In addition, each applicant under twenty-one years of age must present a letter or certificate showing that he has had at least one year's practical experience in some industry related to the course which he wishes to pursue.

Applicants over twenty-one years of age are admitted without examination, and without letter or certificate of practical experience.

Admission as Special Students

Students who desire to pursue special lines of work in the University, and do not desire to become candidates for degrees, will be admitted on the following conditions:

1. The regular entrance requirements must be satisfied.

But applicants who are not less than twenty-one years of age, after obtaining credit for elementary or "grade" work, and for such other subjects as may be necessary to qualify them for the classes that they wish to enter, may, on the presentation of satisfactory reasons, be admitted by the joint action of the Entrance Board and the Executive Committee of the College, to any class in the College; provided, that if any student who has been admitted on these conditions afterwards becomes a candidate for a degree, he shall take the omitted entrance examinations at least two academic years before the degree is conferred.

2. On entering the College, students desiring to pursue special work are required to lay before the Faculty, for approval or modification, a written statement of the end they have in view, the studies proposed for the attainment of that end, and the probable period of

attendance. Such students will be held as strictly to their accepted schemes of work as are the regular undergraduates to their courses of study.

3. Permission to enter as special undergraduates will be refused to all who fail to give satisfactory evidence of definiteness of purpose and will be withdrawn whenever the conditions on which it was granted cease to exist.

Admission to Advanced Standing

1. Applicants who do not come from some other University or College must first obtain admission in the manner already described. They will then be examined on the undergraduate studies for which they ask credits.

2. Applicants who have completed at least one year's work in an approved College, and who bring explicit and official certificates describing their course of study and scholarship, and also letters of honorable dismissal, will be admitted without examination, except such as may be necessary to determine what credit they are to receive here for work done in the College from which they come.

The Stillman W. Robinson Fellowship in Engineering

The Stillman W. Robinson Fellowship in Engineering recently endowed by Emeritus Professor Robinson for the encouragement of graduate research work in engineering, provides three hundred dollars ($300.00) annually, and is open to graduates in Mechanical, Civil, and Electrical Engineering.

Any student to whom this Fellowship is awarded must devote his entire time to the work, which shall amount at least sixteen hours per week, of which at least eight shall be in the line of original research or investigation.

This Fellowship will be awarded on the Friday preceding Commencement Day. All applications must be filed with the committee on or before the first of June of the same year, and must include a general outline of the course of study and research proposed. This must show a definite object to be attained.

The application may be for one or two years, preference being given to candidates electing the two year course. No one will be registered for this graduate course of research who does not satisfy the committee of the Faculty that he has the necessary capacity, fitness and preparation to pursue the work with advantage, and promise of ultimate success.

Great importance will be attached not only to the course laid out to be pursued by the applicant, but to his personal fitness for the work and to his ability to prepare a dissertation or thesis respecting the same which shall be in every way a creditable production, and form a contribution to knowledge.

The investigation may consist of experimental research, or of mathematical analysis, but it usually will be expected to embrace both forms of study. By the beginning of the first year the student must have prepared and submitted a well-defined course, and have registered as a fellow for this Fellowship. Throughout the course of study the student will proceed under the care of the professor who has charge of the line of work being pursued, the same consisting of occasional consultation, instead of recitations.

Students completing the two-year graduate course under the conditions of this Fellowship will receive the degree of D. M.E., D. C.E., or D. E.E., according to the course taken.

Students electing and completing a one-year course will receive the corresponding Master's degree.

The applications for this Fellowship; the approval of the courses of study; the acceptance of the theses; and the recommendations for degrees, are to be passed upon by a committee of the Faculty consisting of the President of the University, the Dean of the College of Engineering, and the professors of Mechanical Engineering, Experimental Engineering, Civil Engineering, Electrical Engineering, and Mathematics.

Fees and Expenses

GENERAL CHARGES.

All term dues must be paid at the opening of each term as a condition of admission to classes.

Incidental Fee.—A charge of six dollars a term, or eighteen dollars a year, is made against all students, under the head of incidental expense. In the case of former students, if this fee is not paid until the second day of the term one dollar will be added, and for each succeeding day of delinquency fifty cents will be added.

Tuition.—Tuition is free in the College of Engineering.

Laboratory Fees.—Students in all laboratory courses are required to pay a flat fee of one dollar per term for each laboratory course taken. The sums thus derived are to cover in part the loss and deterioration of the expensive instruments used by them. In addition, an effort is made in each department to assess upon the students of each laboratory course the cost of the supplies and materials consumed by them. These fees vary considerably in different departments, and they are generally collected in the form of cash advances when the student enters, the unexpended balance being returned to him at the end of the term.

In those departments where the laboratory work is chemical, the student buys a card for five dollars at the beginning of the course, and from that card is supplied with chemicals and apparatus as he needs them, the value of each purchase being punched out of the card at the time. When the card is exhausted, another must be purchased. The store room redeems all unused cards at face value. In addition, a deposit of five dollars is required as security against breakage or loss of the equipment of the desks, which is not supposed to be worn out or consumed as in the case of chemicals.

Gymnasium Locker Fee.—A fee of one dollar a term is required from those who make use of a locker in the gymnasium.

Cadet Uniforms.—The uniform with which the members of the battalion are required to provide themselves costs (without overcoat) about fourteen dollars. It is quiet in pattern, and is designed to be worn in place of civilian dress.

Graduation Fee.— Afee of five dollars, to cover expense of graduation and diploma, is required of each person receiving one of the ordinary degrees from the University, and this fee must be paid before the degree is conferred. A like fee of ten dollars is charged to each person receiving one of the higher graduate degrees.

TOTAL AMOUNT OF FEES.

The element of economy on the part of the student enters somewhat into the cost of pursuing laboratory courses. For this reason it is impossible to fix accurately the costs for a term or a year. In pursuing the courses of the College of Engineering it is not likely that a student could get through a year's work with an expenditure in fees of less than thirty ($30.00) dollars, nor is it likely that the amount would ever exceed fifty ($50.00) dollars, except in cases of fines being assessed for gross carelessness or needless destruction of property.

Rooms and Board.

There are two dormitories on the University grounds for the use of students. Each occupant is charged by the University a rent of a dollar and a half a term.

The South Dormitory affords unfurnished rooms to such students as desire to board themselves, and thus to reduce their expenses to a minimum. The expense of living in this way is about two dollars per week. Applications for rooms should be made to the President of the University.

The North Dormitory will accommodate more than sixty students. Board, furnished rooms, fuel, light and washing are, at present prices, supplied for about three dollars and twenty-five cents a week. Students will be admitted on special recommendation to the President of the University.

Boarding clubs are also formed in the neighborhood of the University. Furnished rooms are rented at seventy-five cents to one dollar a week for each student, and the cost of table board is two dollars to three dollars a week.

Board with furnished rooms can be obtained in private families, within convenient distances of the University, at rates varying from three and a half dollars to five dollars a week. The ruling rate may be taken as four dollars.

ESTIMATE OF EXPENSES.

The expenses of a student in the University for a year may be estimated as follows, excluding clothing (except uniform) and traveling expenses:

	**Low*	*Average*	*High*
Incidental fees	$18 00	$18 00	$18 00
Laboratory fees	15 00	30 00	54 00
Books and stationery	15 00	25 00	50 00
Room	4 50	45 00	75 00
Board	.....	126 00	180 00
Laundry	10 00	20 00	30 00
Miscellaneous	10 00	30 00	75 00
Uniform	14 00	14 00	14 00
Furniture	15 00	.....	.....
Food and supplies	75 00	.....	.....
	$176 50	$308 00	$496 00

---

* Student renting unfurnished room and cooking for himself.

Self Support.—There is a considerable amount of work upon the farm and in the shops and laboratories of the University which may be assigned to students on application. Preference is given to those studying Agriculture or one of the Engineering courses. *The University cannot promise work to all applicants.* Many students find work in private families, in offices and in various occupations, by means of which they defray at least a portion of their expenses. A person of ability and energy, who is master of a trade or who can do good work of any kind, can generally find remunerative employment. It has seldom been known that any student of ordinary energy and industry was obliged to leave the University because of a lack of money for necessary expenses, after having been sixty days on the ground—or long enough to inform himself as to the opportunites for securing employment. As an accommodation the executive office co-operates as far as possible in this matter. The Y. M. C. A. offers its services in helping young men to secure employment. Very much depends, however, on the individual's power of initiative. Students should not come to the University expecting others to find places for them. They should report to the executive office from time to time as to their needs and their work. This will enable the authorities to be more helpful than otherwise would be possible.

A student devoting much of his time to earning his way will be unable to carry successfully the full amount of collegiate work. Such students should apply for the privilege of carrying reduced work in college. This, of course, means that the time required to obtain a degree will be extended to five or more years, according to the amount of work successfully carried each year.

Attendance

Registration. All students are required to register and pay their term fees on or before the first day of each term between the hours of 8 a. m. and 12 m., or between 1 and 4 p. m., central standard time.

Former students who fail to register as above will be charged one dollar in addition to the usual incidental fee for the first day of delinquency, and fifty cents additional for each subsequent day.

No candidate for graduation will be permitted to register for the second term of his graduating year, except upon presentation to the Bursar of the President's certificate that his thesis subject has been announced and approved.

Amount of Work. No student is permitted to take less than fifteen credit hours a week of any sort of work, except by special permission, and no student will be permitted to take more than the regular work of the class to which he belongs, who has not passed all his work for the preceding term.

Credit Hours. "Two consecutive hours of practical or experimental work in any department shall be regarded as the equivalent of one hour of class-room exercise; but when no outside work is required in addition to the laboratory work, then three hours of laboratory work may be required as equivalent to one credit hour; and in general not more than three hours of the student's time, including class hours, shall be required for each credit hour."

Consultation. For consultation regarding work in any class or department, students will apply to the professor or instructor in charge.

For consultation in regard to their status as members of the College of Engineering, or for the filing of petitions, changes of course, changes of class cards, adjustment of schedules and similar needs, students will apply to the Secretary, Brown Hall, Room 31, from 9 to 10 a. m.

On matters connected with the discipline of the institution, students will apply to the President of the University.

Probation. At the close of any term a student failing to pass in two-thirds of his work will be considered on probation for the next three terms; and a second similar failure incurred while thus on "probation" will forfeit his connection with the University.

Courses of Study

All engineering education is based on the constant use of the fundamental sciences, mathematics, physics and chemistry, supplemented by training in the art of expression both by language and by drawing. It naturally follows therefore that all engineering courses start from a common point, proceed side by side for a time, but specialize and subdivide more and more as they progress toward completion, until in the last year they present but little work in common.

Further, it is very commonly the case with young men entering college for a technical education, that they are following ambitions not founded on any knowledge of their own natural aptitudes or capacities, and that they are in no way prepared to make a wise or final selection of their life work at that time.

For these two reasons the work of the first year is made identical in all of the engineering courses leading to a degree. The student is enrolled as a "First-year Engineer." His selection of the course he wishes to pursue is deferred to the latter part of his first year, by which time he has become acquainted to some extent with University standards and methods, with the scope of the various courses offered, and with his own tastes and powers.

First Year

NOTE—The figure in parenthesis following the name of each study indicates the number of the study in its department. A full description of department work follows this statement of Courses.

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Mathematics (31) Algebra.	5.	Mathematics (32) Trigonometry.	5.	Mathematics (33) Analytics.	5.
Chemistry (7) Inorganic.	5.	Chemistry (7) Inorganic.	5.	Chemistry (12) Quantitative Analysis.	4.
Modern Language French, Ger. or Span.	4.	Modern Language French, Ger. or Span.	4.	Modern Language French, Ger. or Span.	4.
English (1) Composition.	2.	English (1) Composition.	2.	English (1) Composition.	2.
Drawing (27) Freehand.	2.	Drawing (25) Freehand.	1.	Drawing (26) Freehand.	1.
		Drawing (31) Geometric.	1.	Drawing (32) Lettering.	2.
Military Drill, Gymnasium		Military Drill, Gymnasium		Military Drill.	

SUMMER TERM IN SHOPWORK—Students electing courses named below are required to take Shopwork courses in the summer term as follows:

Chemical Engineering—Shopwork (7) and (11), at the close of the first or second year.

Ceramics. Electrical Engineering and Mechanical Engineering—Two from Shopwork (4), (7) and (11), at the close of the first year.

Course in Architecture

This course is designed to combine with Architecture as a fine art a thorough training of those phases of engineering which deal with the problems of construction that must be solved before a building can be erected.

Drawing is an important factor in the education of the architect, including that of the artist and of the engineer; being controlled partly by considerations of appearance and partly by those of fact. The following courses indicate the training in the subject of drawing:—freehand drawing from models and plaster casts, brush drawing from cast, still life and out door sketching, pen drawing, clay modeling, photography, geometric drawing, mechanical drawing, descriptive geometry, shades and shadows and architectural perspective.

The history of architecture, necessary to broaden the student's general knowledge and make him familiar with the masterpieces of architectural art, is taught by lectures, reference reading and recitations, being freely illustrated by a selected set of lantern slides which familiarizes the student with the architecture of the past.

Parallel with the history of architecture is a course of drawing which is devoted to the details of the "Orders" of architecture, Romanesque and Renaissance, thereby fixing firmly in mind the characteristics of each.

Decoration and ornament are taught by lectures and practice, considering the important forms of the different styles of architecture in form (clay modeling) and color. Closely allied to decoration and ornament is a study of the principles of architectural composition, given by lectures and assigned problems illustrating the principles.

Architectural design consists of preparing the necessary drawings for proposed structures, such as may be encountered in the practice of first-class professional architects.

The engineering and technical training comprises the following: mathematics, mechanics, strength of materials, stresses in trusses and framed structures, steel skeleton construction and fireproofing for tall buildings, masonry, concrete construction and testing of materials.

Course in Architecture

For Outline of First Year See Page 29

Second Year

First Term.	Credit hours	Second Term.	Credit hours	Third Term.	Credit hours.
Drawing (33) Projections.	3.	Drawing (36) Descriptive Geom.	5.	Drawing (37) Shades, Shadows.	5.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Architecture (9) Hist'y of Architecture.	3.	Architecture (10) Hist'y of Architecture.	3.	Architecture (11) Hist'y of Architecture.	3.
Architecture (12) Detail Drawing.	2.	Architecture (13) Detail Drawing.	2.	Architecture (14) Detail Drawing.	2.
Drawing (14) Pen Drawing.	2.				
Military Drill, Gymnasium		Military Drill, Gymnasium		Military Drill.	

Third Year

First Term.	Credit hours	Second Term.	Credit hours	Third Term.	Credit hours.
Mathematics (71) Statics.	5.	Mathematics (72) Strength Mat'ls, Kinet's	5.	Architecture (24) Framing Details.	2.
Architecture (22) Arch. Composition.	2.	Architecture (23) Designing.	4	Architecture (17) Designing.	4.
Drawing (7) Photography.	2.	Drawing (40) Clay Modeling.	2.	Drawing (41) Clay Modeling.	2.
Architecture (15) Designing.	4.	Drawing (18) Water Color Painting.	2.	Drawing (19) Water Color Painting.	3.
Architecture (5) Decorations, etc.	3.	Civil Eng. (6) Stereotomy.	4.	Civil Eng. (19) Trusses.	5.
English (2) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.

Fourth Year

First Term.	Credit hours	Second Term.	Credit hours	Third Term.	Credit hours.
Architecture (18) Designing.	4.	Architecture (4) Specifications.	2.	Architecture (6) Estimates and Supt.	4.
Civil Eng. (15) Masonry.	5.	Architecture (7) Heating, Vent., etc.	5.	Architecture (19) Designing.	4.
Mech. Eng. (23) Materials of Const.	4.	Architecture (21) Designing.	2.	Architecture (20) Thesis.	5.
Geology (2) General.	5.	Civil Eng. (28) Steel Construction.	5.	Civil Eng. (21) Surveying.	3.
		Civil Eng. (29) Cement Testing.	3.		

THESIS

Course in Ceramics

The ceramic industries include, according to the classification here adopted, those in which the production and utilization of natural and artificial silicates is the end in view, viz., clayware, glass and cement. These three industries constitute a natural division of chemical technology.

Ceramic Engineering is the application of chemical technology and general engineering to this special group of non-metallic mineral industries. The ceramic engineer is supposed to be enough of a geologist to inspect a tract of country and determine whether it possesses mineral resources suited to silicate manufacture, and enough of a mining engineer to be able to economically win the deposits found, whether they are to be quarried superficially or mined deep in the earth. He must be enough of a mechanical engineer to transport, prepare and manufacture these substances into their appropriate forms, rapidly and cheaply. Above all, he must be enough of a chemist to understand the nature of the processes taking place in kilns and furnaces, both as regards the generation of heat, and the formation of new silicate minerals from the earthy raw materials. The intimate relation existing between the composition and properties of silicate products throughout all ceramic operations, and the use of chemical control for maintaining these relations constant, makes the training of the chemical laboratory absolutely necessary to the safe and progressive management of any modern ceramic industry.

These demands are broad and varied, but not more so than those of chemical engineering in general. The field of ceramic engineering is comparatively new in this country, the first course being offered in 1896. The demand for trained men in these industries is not yet as firmly established as in the well-known engineering branches, and ceramic engineers are compelled to a certain extent to act as pioneers in the field. Their employment on a constantly increasing scale is regarded as certain.

Course in Ceramics

For Outline of First Year See Page 29

Summer Term.—Students are required to take *two* of the following courses in shopwork in the summer term at the close of the first year: Shopwork (4), (7) and (11).

Second Year

First Term.	Credit hours	Second Term.	Credit hours	Third Term.	Credit hours.
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (39) Drafting, etc.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Physics (3) Problems.	2.	Physics (3) Problems.	2.	Physics (3) Problems.	2.
Ceramics (1) Laboratory.	5.	Ceramics (2) Laboratory.	5.	Ceramics (3) Laboratory.	5.
Military Drill, Gymnasium		Military Drill, Gymnasium		Military Drill.	

Third Year

Mathematics (71) Statics.	5.	Mathematics (72) Strength Mat'ls, Kinet's	5.	Mathematics (73) Kinetics, Hydraulics.	5.
Ceramics (4) Raw Materials.	5.	Ceramics (5) Clay Products.	5.	Ceramics (6) Clay Products.	5.
Mine Eng. (4) Mine Surveying.	5.	Mech. Eng. (37) Mechanism.	4.	Ceramics (7) Adv. Chem. Lab.	5.
English (2) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.

Fourth Year

Ceramics (9) Manf. of Bodies.	5.	*Ceramics (10) Glasses and Glazes.	5.	*Ceramics (11) Enamels, Colors.	5.
Metallurgy (4) Fuels and Iron.	5.	*Ceramics (12) Cement.	5.	*Ceramics (18) Cement Laboratory.	5.
		Ceramics (22) Physical Chem.	3.	Ceramics (15) Thesis Work.	5.
Geology (2) General.	5.	Geology (6) Economic.	3.	Mech. Eng. (36) Laboratory.	5.
		Geology (7) Petrography.	2.		
Drawing (7) Photography.	2.	Drawing (22) Technical Draw.	2.	Drawing (23) Technical Draw.	2.

THESIS

*Students are to elect Ceramics (10) or (12) and Ceramics (11) or (18).

Course in Chemical Engineering

This course has been prepared to meet the growing demands for trained men in the numerous industries which are based upon chemical processes or employ them prominently in their work, and which are not included in the fields of metallurgy and ceramics. Among such may be mentioned the manufacture of acids, alkalis, salts, chemical reagents, paints, colors, dyes, bleaching powders, soaps, glue, gelatin, glycerine, tanning compounds, starch, sugar, dextrine, glucose, alcohol, ferments, preservatives, antiseptics, fertilizers, matches and many others.

Much of this work has been done in the past without the aid of the chemist. At present it is recognized, however, that in order to carry on the work economically and compete with other countries, the service of the chemist is indispensable. Not only is he able to improve the methods and obtain better products, but he is often able to devise methods for utilizing the by-products and thus lower the cost of production.

The course differs from the ordinary course in chemistry in that it is extended greatly along the engineering lines. This is in accord with the views of the manufacturers as well as experts in technical chemistry. The manufacturer must not only understand the chemical reactions involved in processes; he must also be able to devise machinery for carrying out these reactions on a large scale. Nearly all chemical industries are conducted by the aid of elaborate plants for mechanically treating the materials and handling the products, which in many cases can not be dealt with by hand labor. Consequently mechanical engineering, and to a limited extent, electrical engineering, is demanded and used in these industries. The men at present entering these lines of work are largely mechanical engineers, well trained in this side of the work, but weak and inefficient on the chemical side, which is really fundamental. When a chemist trained only on the chemical side of the work is called upon to fill a position of this kind he naturally finds himself at a great disadvantage, since the work must be carried out on an enormous scale, and not in the beakers and test tubes. The course in chemical engineering has for its object the training of students in the fundamentals of both chemistry and engineering, and thus furnishing men adapted for industrial work.

Course in Chemical Engineering

For Outline of First Year See Page 29

SUMMER TERM.—Shopwork Courses (7), 3 and (11) 3 are to be taken in summer term at the close of the first or second year.

Second Year

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Chemistry (20) Quantitative.	4.	Chemistry (20) Quantitative.	4.	Chemistry (20) Quantitative.	4.
Chemistry (21) Inorganic.	2.	Chemistry (21) Inorganic.	2.	Chemistry (21) Inorganic.	2.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Metallurgy (2) Mineralogy.	3.
		Chemistry (40) Stoichiometry.	1.	Chemistry (40) Stoichiometry.	1.
Military Drill, Gymnasium		Military Drill, Gymnasium		Military Drill.	

Third Year

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Chemistry (8) Organic.	5.	Chemistry (9) Organic.	5.	*Chemistry (9) Organic.	5.
Metallurgy (5) Laboratory.	5.	Metallurgy (6) Assaying.	5.	*Metallurgy (5) Laboratory.	5.
English (2) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.
Mathematics (71) Statics.	5.	Mathematics (72) Strength Mat'ls, Kinet's.	5.	Mathematics (73) Kinetics, Hydraulics.	5.
Drawing (21) Technical.	2.	Drawing (22) Technical.	2.	Drawing (23) Technical.	2.
				Mech. Eng. (32) Power Plants.	5.

*Students are to elect either Chemistry (9) 5, or Metallurgy (5) 5.

Fourth Year

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Chemistry (32) Industrial.	4.	Chemistry (32) Industrial.	4.	Chemistry (15) Sanitary.	4.
Mech. Eng. (18) Machine Design.	5.	Mech. Eng. (18) Machine Design.	5.	Mech. Eng (19) Machine Design.	5.
Elec. Eng. (6) Lectures.	2.	Chemistry (30) Physical.	3.	Chemistry (30) Physical.	3.
Elec. Eng. (7) Laboratory.	2.	*Mech. Eng. (35) Laboratory.	5		
*Metallurgy (4) Fuels and Iron.	5.	*Metallurgy (4) General.	5.	Ceramics (16) General Principles.	5.
*Chemistry (35) Rare Elements.	3.				

THESIS

*Students are to elect Metallurgy (4), two terms; Metallurgy (4) first term, and Mechanical Engineering (35); or Chemistry (35) and Mechanical Engineering (35).

Course in Civil Engineering

Among the special fields which are usually included under the title Civil Engineering, are those of Bridge Engineering, Railroad Construction and Maintenance of Way, Sanitary Engineering, Public Water Supply and Irrigation Engineering, and other special branches such as Topographic and Geodetic Surveying.

The course of instruction is designed to provide the foundation upon which all of these specialties are built. The first two years are, therefore, devoted to the fundamental sciences, to drawing, and to mensuration, and afford an excellent short course in Surveying for those expecting to become deputy county surveyors, or to engage in private practice as land surveyors.

During the third and fourth years, attention is turned to engineering proper, and the drafting and sciences studied during these years apply directly to the art of construction as practiced in each of the specialties of highway, railroad, masonry, and bridge building, and sanitary and hydraulic engineering.

The drafting extends over four years of the course and the student is expected to be able to fill a responsible position at this work upon graduation, and is likewise required to be well versed in mathematics and its applications to his profession.

To keep the course in close touch with practice the department attempts to make each graduate proficient with the instruments of his profession by requiring attendance at Summer surveying camp for two terms of four weeks each, at the end of the second and third years, or submitting suitable experience with some practicing engineer in lieu thereof; by means of work in well-equipped laboratories; and by completing a satisfactory thesis on some practical theme. Much valuable training is to be had from suitable thesis work, and students are urged to begin this during their third year, or the vacation following. The laboratories of the department include facilities for extended work in investigating cements and reinforced concrete, for investigating road materials, and for rating meters and doing other hydrographic work. The remaining laboratories of the college give the student facility in testing other materials of construction, and familiarize him with the elements of steam and electrical engineering practice.

Students contemplating taking the course may gain a better idea of the breadth of the field by noting the positions held by graduates of the department, and by examining a list of the departments of our national government which employ surveyors or civil engineers.

That the course affords the elements of a good business training is evidenced by the fact that a number of graduates are successful railway superintendents and managers of large works.

Course in Civil Engineering

For Outline of First Year See Page 29

Second Year

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Drawing (33) Projections.	3.	Drawing (36) Descriptive Geom.	5.	Drawing (35) Shades, Shadows.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Civil Eng. (1) Land Surveying.	6.	Civil Eng. (4) Topog. Drawing.	4.	Civil Eng. (2) Railroad Surveying.	6.
Military Drill, Gymnasium		Military Drill, Gymnasium		Military Drill.	

SUMMER COURSE.—Civil Engineering (22) 4 weeks, of 6 days per week. Field work in land and railroad surveying.

Third Year

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Mathematics (71) Statics.	5.	Mathematics (72) Strength Mat'ls, Kinet's.	5.	Mathematics (73) Kinetics, Hydraulics.	5.
Civil Eng. (3) Topog. Surveying.	4.	Civil Eng. (24) C. E. Drawing.	5.	Civil Eng. (7) Bridge Stresses.	5.
Civil Eng. (16) Roads and Streets.	5.	Civil Eng. (6) Stereotomy.	4.	Drawing (7) Photography.	2.
Astronomy (4) Mathematical.	3.	Astronomy (5) Mathematical.	3.	Astronomy (6) Mathematical.	4.
English (2) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.

SUMMER COURSE.—Civil Engineering (23) 4 weeks, of 6 days per week. Field work in railroad and topographical surveying.

Fourth Year

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Civil Eng. (8) Bridge Designing.	5.	*Civil Eng. (17) Railways.	5.	Civil Eng. (18) Water Supply.	5.
		*Civil Eng. (25) Adv. Bridge Work.	5.		
Civil. Eng. (15) Masonry.	5.	Civil Eng. (14) Cement Testing.	2.	Civil Eng. (10) Sanitary Eng.	5.
Elec. Eng. (6) Lectures.	2.	Elec.Eng. (6 and 7) Lectures and Lab.	4.		
		Mech. Eng. (17) Laboratory.	3.	Mech. Eng. (25) Laboratory.	5.
Geology (2) General.	5.	Geology (6) Economic.	3.		

THESIS

*Students are to elect either Civ. Eng. (17) or Civ. Eng. (25).

Course in Electrical Engineering

The object of this course is to give such training as shall enable the graduate to successfully take up practical work in those branches of engineering in which electricity plays the principal part. In general, the training needed for this purpose is similar to that of the mechanical engineer, except that the student is not expected to become expert in all of the fields of mechanical engineering, but must have a good knowledge of the whole subject of power generation, transmission and transformation, especially in its electrical form.

The constantly widening field wherein electrical methods are being adopted is making an ever increasing demand for the graduates of technical colleges. Among the industries where electricity is coming into use, perhaps none is more far reaching or important than electric railroading. In addition to the city and suburban lines already thoroughly established throughout the country, the interurban lines are becoming more and more numerous on every hand. Furthermore, the substitution of electricity upon steam roads is just beginning, and it would be a bold man who would set a limit to the progress of this movement. Akin to the above is the use of electric power for the transmission of material over short distances, as in the case of mines, shop railways, cranes, etc. In this line also there still remains much to be done. The driving of machine shops by electricity, although it has become the standard method, and is being installed in all new shops of importance, has yet a wide field for development. In the telephone industry both the manufacturing and operating companies are calling for technical graduates in ever larger numbers, and the engineering side of this work offers a field than which there is perhaps none more interesting. The electro-metallurgical and electro-chemical industries are yet in their infancy. To the electrical engineering graduate there are opened up several different kinds of work. On the one hand the manufacturing companies require men for their engineering, for their commercial and for their manufacturing departments. On the other, a large field is open among the different operating companies for those whose talents lie in this direction. Then, too, some graduates obtain positions with construction companies, where they are engaged in the installation of electrical machinery.

But whatever the employment of the electrical engineer, he exprïences the pleasure of being in touch with a branch of engineering which is constantly growing and developing, so that what is new today will be superceded and laid aside in but a few years.

Course in Electrical Engineering

For Outline of First Year See Page 29

SUMMER TERM.—Students are required to take *two* of the following courses in shopwork in the summer term at close of first year: Shopwork (4), (7) and (11).

Second Year

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Physics (3) Problems.	2.	Physics (3) Problems.	2.	Physics (3) Problems.	2.
Shop. (4, 7 or 11)	3.	Shopwork (13) Machine Work.	3.	Physics (5) Laboratory.	4.
English (2) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.
Military Drill, Gymnasium		Military Drill, Gymnasium		Military Drill.	

Third Year

Mathematics (71) Statics.	5.	Mathematics (72) Strength Mat'ls, Kinet's.	5.	Mathematics (73) Kinetics, Hydraulics.	5.
Physics (6) Laboratory.	5.	Physics (6) Laboratory.	5.	Mech Eng. (32) Power Plants.	5.
Physics (4) Elect'y, Magnetism.	3.	Mech. Eng. (37) Mechanism.	4.	Mech. Eng. (28) Laboratory.	2.
Shopwork (14) Machine Work.	3.	Elec. Eng. (8) D. C. Machinery.	4.	Elec. Eng. (9) Laboratory.	4.
Drawing (5) Technical.	3.			Elec. Eng. (15) A. C. Machinery.	2.

Elec. Eng. (20), (21), (22) or (23) is taken at the end of the winter term.

Fourth Year

Elec. Eng. (16) A. C. Machinery.	3.	Elec. Eng. (17) A. C. Machinery.	2.	Elec. Eng. (13) Applications.	5.
Elec. Eng. (11) Laboratory.	3.	Elec. Eng. (11) Laboratory.	3.	Elec. Eng. (11) Laboratory.	3.
Mech. Eng. (33) Engines and Boilers.	5.	Elec. Eng. (18) Elec. Design.	3.	Elec. Eng. (19) Designing.	4.
Mech. Eng. (29) Laboratory.	3.	Elec. Eng. (12) Transmission.	2.		
		Mech. Eng. (30) Laboratory.	2.		
		Ind. Arts (9) Mach. Design.	2.		
*Elective	3-5	*Elective	3-5	*Elective	3-5

Elec. Eng. (20), (21), (22) or (23) is taken at the end of the winter term.

THESIS

*Subject to the approval of the Professor of Electrical Engineering.

Course in Industrial Arts

This course is designed for those who may desire to occupy positions in the various branches of manufacture, not as engineers, but as practical managers, superintendents or business men.

As the growth of engineering has brought about its subdivision into many special lines, such as civil, mechanical, electrical, mining, and chemical engineering, and established special training for each, so the increase in size, importance and scope of the manufacturers of the country has made it desirable to especially train young men with reference to filling positions of trust and responsibility in them; to so educate them that they can readily learn the treatment or processes in any special line of manufacture and be able to intelligently superintend; and can initiate and put into successful operation new industrial enterprises, or extend and improve old ones.

With this idea in view this course has been planned to give the student special training along industrial and business lines, together with a certain amount of general culture. There will be found in this course a large amount of science training by which the processes of manufacture based upon these laws may be more readily understood; practice in the different shops and in drawing, so that a good working knowledge of such operations may be acquired, as well as training given to eye and hand, and power of observation and thought developed along mechanical lines; studies into the principles and methods governing the production of the chief materials of construction, the different mechanical movements and their combinations in machinery, the use of materials in various constructions, electrical machinery and steam power plants, together with laboratory practice; also the relations of capital and labor, the problems of trade, and the conduct of business enterprises.

This course is well adapted to meet the needs of those young men already employed in industrial pursuits at the machine or bench, who are ambitious to advance to positions of greater responsibility and influence. This course offers an excellent opportunity to such men; it gives them four years of earnest work under good instructors to direct and assist personally, and the advantages of laboratory work to supplement the theoretical book-work.

Course in Industrial Arts

For Outline of First Year See Page 29

Second Year

First Term.	Credit hours	Second Term.	Credit hours	Third Term.	Credit hours.
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Physics (3) Problems.	2.	Physics (3) Problems.	2.	Physics (3) Problems.	2.
Shopwork (7) Woodwork.	3.	Shopwork (9) Adv. Pattern Making.	3.	Shopwork (8) Cabinet Work.	3.
Shopwork (3) Foundry.	3.	Shopwork (11) Forging.	3.	Shopwork (12) Adv. Forging.	3.
English (2) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.
Economics (30) Indus. and Soc. Hist.	3.	Economics (31) Indus. and Soc. Hist.	3.	Economics (32) Com. and Econ. Geog.	3.
Military Drill, Gymnasium		Military Drill, Gymnasium		Military Drill.	

Third Year

Drawing (5) Technical.	3.	Industrial Arts (2) Designing.	3.	Industrial Arts (2) Designing.	3.
Industrial Arts (1) Tools and Machines.	3.	Industrial Arts (1) Tools and Machines.	3.	Industrial Arts (1) Tools and Machines.	3.
Shopwork (4) Chipping and Filing.	3.	Shopwork (13) Machine Work.	3.	Shopwork (14) Machine Work.	3.
Metallurgy (4) Fuels and Iron.	5.	Metallurgy (4) Steel.	2.	Mech. Eng. (32) Power Plants.	5.
Economics (33) Elem. of Polit. Econ.	3.	Economics (33) Elem. of Polit. Econ.	3.	Economics (33) Elem. of Polit. Econ.	3.
		Civil Eng. (27) Timber and Masonry.	3.		

Fourth Year

Shopwork (15) Adv. Mach. Work.	3.	Shopwork (16) Adv. Mach. Work.	3.	Shopwork (17) Adv. Mach. Work.	3.
Elec. Eng. (6) Lectures.	2.	Elec. Eng. (6) Lectures.	2.	Civil Eng. (21) Surveying.	3.
Elec. Eng. (7) Laboratory.	2.	Elec. Eng. (7) Laboratory.	2.		
Industrial Arts (3) Shop Equipment.	3.	Industrial Arts (3) Shop Appliances.	3.	Industrial Arts (3) Shop Management.	3.
Industrial Arts (4) Adv. Designing.	3.	Industrial Arts (4) Adv. Designing.	3.	Industrial Arts (4) Adv. Designing.	3.
Mech. Eng. (12) Laboratory.	2.	Mech. Eng. (29) Laboratory.	2.	Mech. Eng. (30) Laboratory.	2.
Economics (34) Immigration, Money.	2.	Economics (35) Railroads, Tariff, etc.	2.	Economics (36) Labor and Capital.	2.

THESIS

Course in Manual Training

This course is designed for those who wish to become teachers of manual training in the public schools of secondary grade or in technical schools. It is necessary that a teacher of manual training in the public schools be of the same high standard as his associates in character, general culture and uplifting influence. He must possess knowledge of the methods of instruction and ability in the art of teaching; and coupled with these, he must have skill in his technical lines. He must be familiar with the tools, materials and processes used, and acquainted with the different effects on his pupils of the training and work with these. He must understand that enlarged power and ability in the student is what he is seeking; that the pupil himself and not the inanimate object used is the real product of his efforts.

The value of manual training as a needed factor in the education of modern days is recognized. In the old times when so many machine made articles were not in the market and living was not so diversified, the children of the family received their manual training at their homes and under their parents as teachers. There were the household duties assigned to them and things to be made and repaired and ideas of improvements to be wrought out. These were done with a good deal of hand work and a valuable training was obtained. Now this training is brought about by the introduction of manual work into the schools from the lowest to the highest. The nature of the teaching is individual and characteristic of that of the laboratory. In the higher schools the materials used in the manual training are those in common use, wood and iron; and the principles underlying the working of them in the various industries are studied and practiced. Accompanying this is the use of drawing as a means of conveying ideas.

The skill acquired by the pupil and the clear conception of fundamental facts react upon and strengthen the work in other lines.

As the work is arranged in the course offered the student is well grounded in the sciences of mathematics, physics and chemistry, and can plan his manual training work to help more directly the other lines of work of his pupils. Opportunities for teachers in this line are increasing. Many high schools are introducing the work and in some states special technical high schools have been created.

Course in Manual Training

For Outline of First Year See Page 29

Second Year

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credi hours
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Physics (3) Problems.	2.	Physics (3) Problems.	2.	Physics (3) Problems.	2.
Shopwork (7) Woodwork.	3.	Shopwork (9) Adv. Pattern Making.	3.	Shopwork (8) Cabinet Work.	3.
Shopwork (3) Foundry.	3.	Shopwork (11) Forging.	3.	Shopwork (12) Adv. Forging.	3.
English (2) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Briet-Making, etc.	2.
Education (1) Elem. Psychology.	3.	Education (1) Elem. Psychology.	3.	Education (1) Elem. Psychology.	3.
Military Drill		Military Drill		Military Drill	
Gymnasium		Gymnasium			

Third Year

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours
Drawing (5) Technical.	3.	Industrial Arts (2) Designing.	3.	Industrial Arts (2) Designing.	3.
Industrial Arts (1) Tools and Machines.	3.	Industrial Arts (1) Tools and Machines.	3.	Industrial Arts (1) Tools and Machines.	3.
Shopwork (4) Chipping, Filing.	3.	Shopwork (13) Machine Work.	3.	Shopwork (14) Machine Work.	3.
History (1) U. S. Political.	3.	History (1) U. S. Political.	3.	History (1) U. S. Political.	3.
*Chemistry (20) Quantitative.	4.	*Chemistry (20) Quantitative.	4.	*Chemistry (20) Quantitative.	4.
*Chemistry (21) Physical.	2.	*Chemistry (21) Physical.	2.	*Chemistry (21) Physical.	2.
*Physics (5) Laboratory.	5.	*Physics (5) Laboratory.	5.	*Physics (5) Laboratory.	5.

*Students take either Chemistry (20) and (21) or Physics (5).

Fourth Year

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours
Shopwork (15) Adv. Mach. Work.	3.	Shopwork (16) Adv. Mach. Work.	3.	Mech. Eng. (32) Power Plants.	5.
Elec. Eng. (6) Lectures.	2.	Elec. Eng. (6) Lectures.	2.	Mech. Eng. (28) Laboratory.	2.
Elec. Eng. (7) Laboratory.	2.	Elec. Eng. (7) Laboratory.	2.		
Education (5) Science of Educ.	3.	Education (5) Science of Educ.	3.	Education (5) Science of Educ.	3.
Polit. Science (1) Polit. Inst. of U. S.	3.				
Electives	2-5.	Electives	5-7.	Electives	5-7.

THESIS

Course in Mechanical Engineering

Mechanical engineering deals with the generation of power from the forces of nature and the utilization of this power in machinery by means of mechanism for the manufacture of different products. Physics is the fundamental science underlying this profession, especially those parts of physics relating to mechanics and heat. Chemistry is required for understanding the constitution of the materials used and for the changes which take place during combustion. Mathematics is the tool by which scientific principles are made applicable to practical engineering problems, and English is the medium by which the conclusions are made known to others.

One of the great fields of mechanical engineering is the generation of power by means of the steam boiler, steam engine and steam turbine. The great advances of the past century have been made possible by improvements in these lines. Recently a rival has sprung up for steam; the field of gas engineering, which includes the manufacture and utilization of fuel in gaseous form directly in the engine, will probably furnish sweeping changes in the generation of power. The utilization of water power and the power of the wind also form fields for the mechanical engineer. The application of the power, whatever its manner of generation, can be had either directly by pumps, air compressors and electrical machinery or indirectly through shafting, belting and ropes. These applications furnish other opportunities. The machinery called for and designed by the mechanical engineer includes all that is used in the different industrial establishments, from the large machines found in rolling mills, steel works and heavy manufacturing establishments, to the delicate machinery used in the manufacture of watches. Still another branch includes such allied subjects as heating, ventilation and refrigeration.

The training given in this course is designed to equip men with such general and technical knowledge that they can take up the work in any of the numerous branches of the profession, and, adapting themselves to the needs of the situation, can rapidly acquire the practical experience which is essential to success in that particular line. No one who lacks broad preliminary training for the profession can ever expect to attain its highest positions.

Course in Mechanical Engineering

For Outline of First Year See Page 29

Second Year

SUMMER TERM.—Students are required to take *two* of the following courses in shopwork in the summer term at the close of the first year, Shopwork (4), (7) and (11).

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Shopwork (3) Foundry.	2.	Physics (7) Laboratory.	2.	Physics (7) Laboratory.	3.
English (2) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.
Shopwork (4, 7, 9 or 11)	3.	Shopwork (4, 9 or 11)	3.	Shopwork (13) Machine Work.	3.
Military Drill, Gymnasium		Military Drill, Gymnasium		Military Drill.	

Third Year

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Mathematics (71) Statics.	5.	Mathematics (72) Strength Mat'ls, Kinet's.	5.	Mathematics (73) Kinetics, Hydraulics.	5.
Mech. Eng. (12) Laboratory.	2.	Mech. Eng. (3) Mechanism.	5.	Mech. Eng. (3) Mechanism.	2.
Drawing (5) Technical.	3.	Civil Eng. (27) Timber, Masonry.	3.	Drawing (7) Photography.	2.
Metallurgy (4) Fuels and Iron.	5.	Metallurgy (4) Steel.	2.	Civil Eng. (19) Trusses.	5.
Shopwork (14) Machine Work.	3.	Shopwork (15) Adv. Machine Work.	4.	Mech. Eng. (32) Power Plants.	5.
Mathematics (11) Diff. Equations.	1.				

Mech. Eng. (38), (39), (40) or (41) is taken at the end of the winter term.

Fourth Year

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Mech. Eng. (33) Engines and Boilers.	5.	Mech. Eng. (34) Thermodynamics.	5.	Mech. Eng. (21) Thesis.	5.
Mech. Eng. (27) Laboratory.	5.	Mech. Eng. (14) Laboratory.	4.	Mech. Eng. (15) Laboratory.	3.
Mech. Eng. (18) Machine Design.	5.	Mech. Eng. (18) Machine Design.	5.	Mech. Eng. (19) Machine Design.	5.
Elec. Eng. (6) Lectures.	2.	Elec. Eng. (6) Lectures.	2.	Industrial Arts (5) Shop Appliances.	3.
Elec. Eng. (7) Laboratory.	2.	Elec. Eng. (7) Laboratory.	2.	Mech. Eng. (31) Hydraulic Machinery.	3.

THESIS

Mech. Eng. (38), (39), (40) or (41) is taken at the end of the winter term.

Course in Mining Engineering

The profession of mining engineering involves two distinct fields, that of the engineer and that of the metallurgist. A man may devote himself to either of these departments, but a competent understanding of both is essential to the successful designing and development of mining or metallurgical plants.

On the engineering side the work is directed to the excavation and working of mineral resources. In this are involved the geological features of the locality; the opening of the property; the mechanical handling of the ores or coal; the surveying and mapping of the mining operations and the proper drainage and ventilation of the mine.

In its metallurgical aspects mining engineering is confined to the reduction of the metals from their ores, the manufacture and alloying of the metals, and the treatment and utilization of fuels from the standpoint of the effective generation of a calorific power rather than the conversion of the power to other forms of energy.

The professional outlook for the mining engineer is good. The development of coal mining has given rise to a considerable demand for trained men to have charge of the engineering work involved and ultimately for the general management of the business. The widely distributed fields for the mining of metallic minerals and the special and somewhat isolated character of many of the plants, make the training of the mining engineer of special importance in their management. In connection with the larger reduction plants, with steel manufacture and with iron blast furnaces there is a growing demand for men trained as metallurgical chemists. The industries dealing with the treatment and smelting of ores are growing rapidly and are in need of trained men.

The course of study offered includes a thorough training in general science, especially chemistry, mathematics, physics, mineralogy and geology. Special instruction is given in the arts which relate particularly to mining and metallurgy, such as drafting, surveying, technical chemical analysis and assaying. Experience has shown that these subjects enable a man to be of use in the industry during the time in which he is acquiring that experience and judgment which are essential to his ultimate success. Upon this broad foundation are based the special professional studies along the lines of metallurgy and of engineering. This work is supplemented by visits to accessible mines and metallurgical works for study and comparison.

Course in Mining Engineering

For Outline of First Year See Page 29

Second Year

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Metallurgy (5) Laboratory.	5.	Metallurgy (5) Laboratory.	5.	Metallurgy (5) Laboratory.	5.
Shopwork (7) Woodwork.	2.	Shopwork (11) Forging.	2.	Metallurgy (2) Mineralogy.	3.
Military Drill, Gymnasium		Military Drill, Gymnasium		Military Drill.	

Third Year

Mathematics (71) Statics.	5.	Mathematics (72) Strength Mat'ls, Kinet's.	5.	Mathematics (73) Kinetics, Hydraulics.	5.
Metallurgy (4) Fuels and Iron.	5.	Metallurgy (4) General.	5.	Metallurgy (3) Deter. Mineralogy.	5.
Mine Eng. (4) Mine Surveying.	5.	Metallurgy (6) Assaying.	5.	Civil Eng. (19) Trusses.	5.
English (2) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.
		Mine Eng. (7) Surveying.	1.		

Fourth Year

Mine Eng. (5) Mine Engineering.	5.	Mine Eng. (5) Mine Engineering.	5.	Mine Eng. (5) Mine Engineering.	5.
Geology (2) General.	5.	Geology (6) Metal Construction.	3.	Mech. Eng. (36) Laboratory.	5.
Metallurgy (8) Ore Dressing.	2.	Metallurgy (7) Lectures.	3.	Mine Eng. (6) Plans and Specifications.	5.
Elec. Eng. (6) Lectures.	2.	Elec. Eng. (6) Economic.	2.	Drawing (7) Photography.	2.
Elec. Eng. (7) Laboratory.	2.	Elec. Eng. (7) Laboratory.	2.		
		Geology (7) Petrography.	2.		

THESIS

Courses Not Leading to a Degree

The following short courses are offered by the University in the belief that they will meet the needs of a large class of young men who for some reason will not or cannot obtain the benefits of the thorough courses already described. The University recognizes that there are many valid reasons which may stand in the way of some, whose ability to receive and to use the highest forms of education is without question; and it is thought that in extending opportunities for such training as will be available to these young men, the University is filling a longfelt want in the scheme of engineering education, and is certain to grow into closer contact with the industrial life of the State.

No diploma is given to those who complete these courses, but a certificate is issued stating the list of studies which the student has taken in his course, and in which his work has been satisfactory.

The requirements for admission to these short courses are very much lower than for admission to regular collegiate work. It is clear that to reach the young men for whom these courses have been designed, it is necessary that the conditions of admission and attendance shall be shorn of every complication and that the opportunity extended shall be within the grasp of all, and with the minimum of formality or restriction. It is considered, however, that those who accept these opportunities are men, mature in character and steadfast in their purpose to gain sufficient technical education for their needs, and who are making a sacrifice of time at an age when time has begun to be precious.

The somewhat elementary character of some of the work of these courses may attract the attention of some, who as candidates for admission to regular collegiate work could not be admitted on account of their insufficient preparation. To all such students it is proper to state that these courses are in no sense designed as preparatory schools for those who desire ultimately to enter college, and it is not the purpose of the college to permit such use to be made of them. Therefore, every candidate for admission to the short courses must satisfy the Entrance Board that his previous experience will enable him to utilize this opportunity in a proper way. For the detailed requirements for admission to these Short Courses see page 22.

Short Course in Clay Working

The two-year course is designed to assist young men who have already been actively engaged in the Ceramic industries, and who, on account of mature years, or lack of means, or lack of previous educational advantages, are unable to avail themselves of the full and complete course, and yet who wish to increase their earning power or chances of promotion by fitting themselves for other than routine labor. This course comes into as close a touch with the wants of the clay industries as is possible in so brief a time. It is intended to make its benefits available to the greatest number.

NOTE—The figure in parenthesis following the name of each study indicates the number of the study in its department. A full description of department work follows this statement of Courses.

First Year

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Chemistry (3) Inorganic.	5.	Chemistry (3) Inorganic.	5.	Chemistry (12a) Quantitative.	5.
Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.
Mathematics (3) Plane Geom.	5.	Mathematics (13) Space Geom.	5.	Mathematics (14) Trigonometry.	5.
Drawing (2) Lettering.	3.	Drawing (38) Projections.	3.	Drawing (39) Drafting.	3.
Military Drill, Gymnasium		Military Drill, Gymnasium		Military Drill.	

SUMMER TERM.—Students are required to take Shopwork (7) and (11) in the summer term at the end of the first year. But they may be excused from this where they are able to obtain positions in some ceramic establishment for the summer; and on presentation of a satisfactory certificate, endorsed by the head of the department, work in a ceramic factory during the summer may be counted as equivalent to the summer shop course.

Second Year

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Ceramics (1) Laboratory.	5.	Ceramics (2) Laboratory.	5.	Ceramics (19) Laboratory.	5.
Ceramics (4) Raw Materials.	5.	Ceramics (5) Clay Products.	5.	Ceramics (6) Clay Products.	5.
Physics (1) Elementary.	5.	Physics (1) Elementary.	5.	Ceramics (23) Clay Products.	7.
Ceramics (20) Raw Materials.	2.	Ceramics (21) Clay Products.	2.		
Military Drill, Gymnasium		Military Drill, Gymnasium		Military Drill.	

Short Course in Industrial Arts

This course is primarily designed to extend the benefits of the same kind of training as that given in the four-year course in this subject to that class of young men who may be unable for any reason to undertake a course of four years' duration, but who aspire to become actively engaged in factory work. It has been the aim to give, in as condensed form as possible, those studies which will most rapidly and easily be turned to practical account in manufacturing operations; such as drawing, shopwork, use of machine tools, etc., together with a grounding in the physics, mathematics and mechanisms which underlie these operations.

The course will be found most valuable to young men already engaged in factory work, who find themselves limited from rising in their work on account of lack of technical education.

NOTE—The figure in parenthesis following the name of each study indicates the number of the study in its department. A full description of department work follows this statement of Courses.

First Year

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Drawing (24) Freehand.	1.	Drawing (25) Freehand.	1.	Drawing (26) Freehand.	1.
Drawing (2) Lettering.	3.	Drawing (38) Projections.	3.	Drawing (39) Drafting.	3.
Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.
Mathematics (3) Plane Geometry.	5.	Mathematics (13) Space Geometry.	5.	Mathematics (14) Trigonometry.	5.
Shopwork (7) Pattern Making.	3.	Shopwork (9) Adv. Pattern Making.	3.	Shopwork (11) Forging.	3.
Military Drill, Gymnasium		Military Drill, Gymnasium		Military Drill.	

Second Year

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Industrial Arts (8) Machine Drawing.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Industrial Arts (1) Tools, Machines.	3.	Industrial Arts (1) Tools, Machines.	3.	Industrial Arts (1) Tools, Machines.	3.
Physics (1) Elementary.	5.	Physics (1) Elementary.	5.	Geology (1) Phys. Geography.	5.
Shopwork (4) Chipping, Filing.	3.	Shopwork (13) Machine Work.	3.	Shopwork (14) Adv. Machine Work.	3.
Shopwork (3) Foundry.	2.	Industrial Arts (2) Designing.	3.	Industrial Arts (2) Designing.	3.
Military Drill, Gymnasium		Military Drill, Gymnasium		Military Drill.	

Short Course in Mining

The short course in mining is especially designed for young men who have had practical experience in mines, and wish to study mine surveying, drafting, the problems of ventilation, drainage, haulage, mine operating, etc., and also something of the sciences bearing upon their work, but have neither time nor preparation for a full college course. The first year is devoted to a thorough study of the elementary mathematics and sciences necessary to prepare the student for the practical work of the second year. Experience has shown beyond any doubt that any enterprising young miner can master the subject sufficiently well in the time assigned to materially increase his earning capacity and chances for promotion in his occupation.

Personal instruction is given, and it is made thoroughly practical and of such a character as to best adapt it to the needs of the individual student.

NOTE—The figure in parenthesis following the name of each study indicates the number of the study in its department. A full description of department work follows this statement of Courses.

First Year

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.
Mathematics (3) Geometry.	5.	Mathematics (13) Space Geometry.	5.	Mathematics (14) Trigonometry.	5.
Physics (1) Elementary.	5.	Physics (1) Elementary.	5.	Geology (1) Phys. Geography.	5.
Military Drill, Gymnasium		Military Drill. Gymnasium		Military Drill,	

Second Year

Drawing (2) Lettering.	3.	Drawing (38) Projections.	3.	Drawing (39) Drafting.	3.
Drawing (27) Freehand.	2.	Geology (4) Elementary.	5.	Shopwork (11) Forging.	3.
Chemistry (3) Inorganic.	5.	Chemistry (3) Inorganic.	5.	Metallurgy (9) Mineral Chemistry.	5.
Mine Eng. (1) Mine Surveying.	5.	Mine Eng. (2) Ventilat. Haulage.	5.	Mine Eng. (3) Mine Operating.	5.
		Mine Eng. (7) Surveying.	1.		
Military Drill, Gymnasium		Military Drill, Gymnasium		Military Drill.	

Architecture

(DEPARTMENT OF ARCHITECTURE AND DRAWING.)

Office, Room 22, Brown Hall.

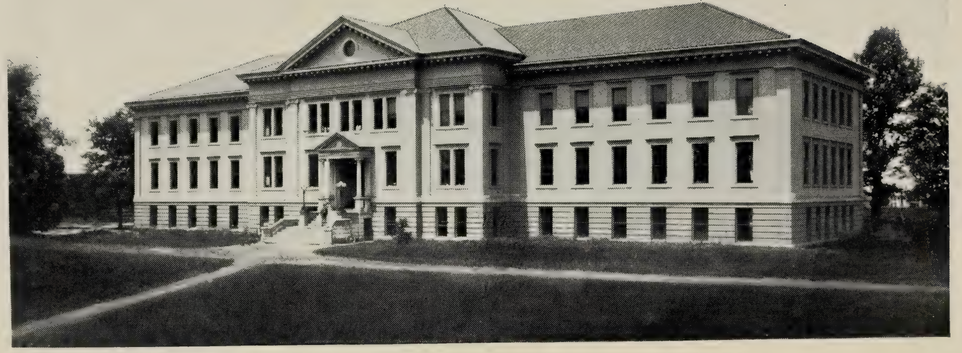
PROFESSOR BRADFORD, ASSOCIATE PROFESSOR FRENCH, MR. ———

The Department work in Architecture is carried on in Brown Hall. Two well-lighted designing rooms are equipped with the needed tables, lockers, etc., and the lecture room is provided with an electric projection lantern. The department has much material for consultation and study, including models in plaster and wood illustrating the constructive and ornamental forms of different styles of architecture, photographs and lantern slides, drawings and specifications of erected structures, plates of architectural forms and ornaments, samples of building material. Various structures are continually in process of erection in the city and furnish examples of practical nature. For experimental work in heating and ventilation there are the necessary instruments such as anemometers, hygrometers, carbonic acid testers and thermometers. The several buildings of the University give good opportunity for this work.

The Mechanical Drawing and Photography are taught in Brown Hall. For the Mechanical Drawing there are four large well-lighted drafting rooms with necessary tables and lockers, and two lecture rooms equipped with electric projection lantern. A set of Schroeder models and a collection of shop drawings are available. There are two blue-print rooms, one provided with an Elliott electric light printing machine, the other with sun frames. For Photography there is an especially built dark room with forty-three developing compartments; also two laboratories equipped with toning and mounting tables; printing apparatus, copying cameras, lenses of long and of short focus, tele-photographic lens, color screens, shutters, and an excellent outfit for photo-micrography.

The Freehand Drawing, Painting and Modeling are carried on in Hayes Hall. The rooms are equipped with the usual tables, models and casts, easels, modeling tools and other needed apparatus.

4. Specifications. Lectures and practice in preparing specifications for architectural structures. Two credit hours. Course in Architecture, fourth year, second term, Tu., 11, and assigned work. Prerequisite, Architecture 18. PROFESSOR BRADFORD.



BROWN HALL.

5. Decoration and Ornament. Lectures on the different styles of carved ornament and decorative color. The practice part of this subject will be incorporated in the Clay-Modeling and Designing. Three credit hours. Course in Architecture, third year, first term, M., W., 9, F., 9-11. Prerequisite, Drawing 37 and Architecture 14. PROFESSOR BRADFORD.

6. Estimates and Superintendence. Lectures and practice in preparing estimates for structures designed in 11, 12, 13 and 21, and the duties of superintendence. Four credit hours. Course in Architecture, fourth year, third term, M., W., 8, W., 1-5. Prerequisite, Architecture 21, Concurrent Architecture 19. PROFESSOR BRADFORD.

7. Heating, Ventilating and Plumbing. Lectures and experimental work. Lectures on the principles and methods of heating and ventilating and of sanitary plumbing. Experimental work is carried on with the heating and ventilating plants in the different University buildings. Five credit hours. Course in Architecture, fourth year, second term, M., Tu., F., 10, M., 1-5. Prerequisite, Architecture 18. PROFESSOR BRADFORD.

9. History of Architecture. Lectures illustrated by lantern slides. Three credit hours. Course in Architecture, second year, first term, M., W., F., 11. PROFESSOR BRADFORD.

10. Continuation of 9. Course in Architecture, second year, second term, M., W., F., 11. PROFESSOR BRADFORD.

11. Continuation of 10. Course in Architecture, second year, third term, M., W., F., 11. PROFESSOR BRADFORD.

12. Architectural Drawing. Drawing architectural ornament, details of orders and styles, with the special object of impressing upon the student's mind the architectural characteristics considered in Course 9. Two credit hours. Course in Architecture, second year, first term, W., Th., 2-4. Concurrent, Drawing 33 and Architecture 9. PROFESSOR BRADFORD.

13. Continuation of 12. Course in Architecture, second year, second term, W., Th., 2-4. Concurrent, Architecture 10. PROFESSOR BRADFORD.

14. Continuation of 13. Course in Architecture, second year, third term, W., Th., 2-4. Concurrent, Architecture 11. PROFESSOR BRADFORD.

15. Designing. Lectures and practice in designing suburban dwellings. Four credit hours. Course in Architecture, third year, first term, W., Th., 1-4, F., 1-3. Prerequisite, Architecture 14 and Drawing 37. PROFESSOR BRADFORD.

17. Designing. School buildings. Four credit hours. Course in Architecture, third year, third term, W., Th., 1-4, F., 1-3. Prerequisite, Architecture 23. PROFESSOR BRADFORD.

18. Designing. Public buildings. Four credit hours. Courses in Architecture, fourth year, first term, Th., F., 1-5. Prerequisite, Architecture 17. PROFESSOR BRADFORD.

19. Designing. Ecclesiastical architecture. Four credit hours. Course in Architecture, fourth year, third term, Th., 11, Th., F., 1-4. Prerequisite, Architecture 21. PROFESSOR BRADFORD.

20. Thesis. Original design to be accompanied with written description, specifications and estimate. Five credit hours. Course in Architecture, fourth year, third term.

21. Architecture of Tall Skeleton-Constructed Buildings. Two credit hours. Course in Architecture, fourth year, second term, Th., 11, F., 1-3. Prerequisite, Architecture 18. Concurrent, Civil Engineering 28. PROFESSOR BRADFORD.

22. Principles of Architectural Composition. Two credit hours. Course in Architecture, third year, first term, Tu., Th., 9. Concurrent, Architecture 5. PROFESSOR BRADFORD.

23. Designing. Modern apartment houses. Four credit hours. Course in Architecture, third year, second term, W., Th., 1-4, F., 1-3. Prerequisite, Architecture 15. PROFESSOR BRADFORD.

24. Framing Details. Two credit hours. Course in Architecture, third year, third term, F., 8-11. Prerequisite, Architecture 23. PROFESSOR BRADFORD.

Astronomy

Office, Emerson McMillin Observatory.

PROFESSOR H. C. LORD, MR. J. WARREN SMITH, MR. B. F. MAAG.

The Observatory was founded in 1895 through the generosity of Mr. Emerson McMillin. The building and equipment are designed primarily for the purpose of instruction. The aim of the teaching is to give a mastery of the fundamental principles rather than to accumulate a mass of half-understood measurements.

The main building contains an office, library, assistants room, students' computing room, lecture room, comparator room, clock room, two observing rooms, the twenty-five foot dome, photographic dark room, spectroscopic laboratory and an instrument shop room. There is also a specially designed theodolite house.

The equipment consists of six sextants, two small theodolites, five chronometers, a Riefler standard clock and 2½-inch zenith telescope, Troughton & Simms; for accurate time or longitude there is provided a 3-inch combined portable transit and zenith telescope by Saegmuller, and chronograph by Warner & Swasey. For refined azimuth determination there is a theodolite by Troughton & Simms, equipped with 12-inch horizontal and vertical circles, reading to single seconds of arc.

Further equipment comprises a 12½-inch equatorial telescope with mounting by Warner & Swasey, and objective by Brashear, and a Universal star spectroscope by Brashear; a position micrometer by Warner & Swasey; a 4-inch portable equatorial by Alvan Clark; comparator by Zeiss, and a set of meteorological instruments. A 2-horse power gas engine, dynamo and a large storage battery are also provided.

Ten students can be worked each clear night under constant supervision of the instructor, the inconvenience of open air observations being reduced to a minimum.

4. Astronomy, Geodesy and Least Squares. Lectures on practical astronomy, supplemented by practice with the instruments of the Emerson McMillin Observatory. Three credit hours. Courses in Civil Engineering, third year, first term. Lecture M., W., F., 11. Laboratory hours arranged with the students individually. Prerequisite, Mathematics 43 and Physics 2.
5. Continuation of 4. Three credit hours. Course in Civil Engineering, third year, second term. Lecture M., W., F., 11. Laboratory hours arranged with the students individually.
6. Continuation of 5. Laboratory work. Four credit hours. Course in Civil Engineering, third year, third term. Hours arranged with the students individually.

Ceramics

(DEPARTMENT OF CLAY WORKING AND CERAMICS.)

Office, Orton Hall, Room 4.

PROFESSOR EDWARD ORTON, JR., ASSISTANT PROFESSOR BLEININGER, MR. PURDY.

The equipment of the department is exceptional; it was provided by special act of the State Legislature, and has been extended by many valuable gifts and purchases. It now occupies about 6,000 square feet of floor space, but in the new School of Mines Building, now in process of erection, its room will be more than doubled, and its facilities greatly improved. The equipment comprises a chemical laboratory, a stock and preparation room, a pottery laboratory, a machine room, chiefly devoted to grinding minerals and manufacturing and testing structural materials, bricks, etc., a kiln house, a lecture and study room, the nucleus of a museum, and library facilities unusually complete on the technical side.

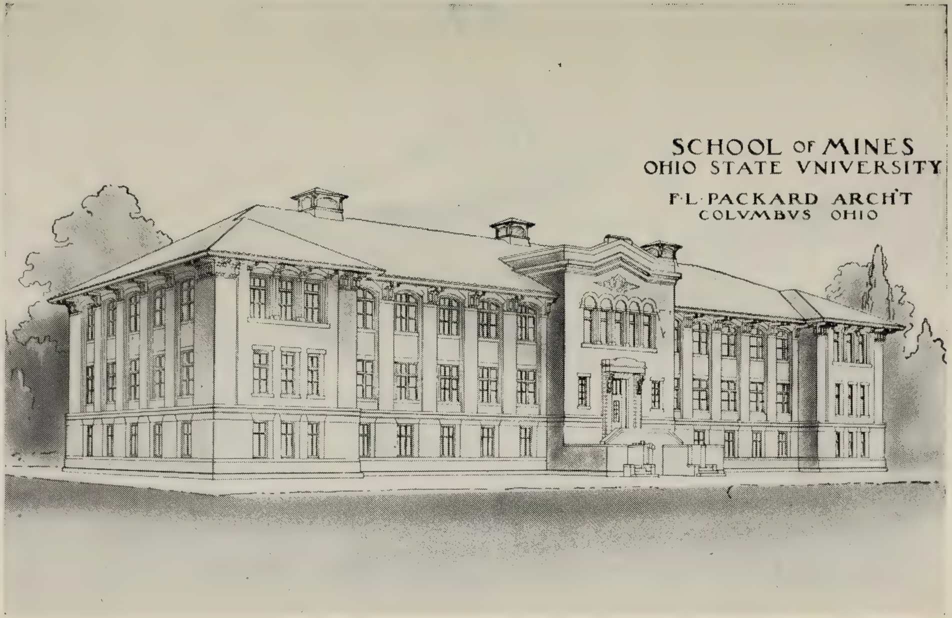
The department is also much assisted by the co-operation of clay and cement manufacturers who have afforded opportunities for experimental work in their plants.

1. Ceramic Chemistry. Quantitative analysis of salts, limestone and other simple minerals. Five credit hours. Course in Ceramics and Short Course in Clay-working, second year, first term, M., Tu., W., 1-4. Prerequisite, Chemistry 12 or 12a. ASSISTANT PROFESSOR BLEININGER.

2. Continuation of 1. Quantitative analysis of clays and similar minerals; first, samples of known composition; later, unknown materials. Five credit hours. Course in Ceramics and Short Course in Clay-working, second year, second term, M., Tu., W., 1-4. ASSISTANT PROFESSOR BLEININGER.

3. Continuation of 2. Completion of the ultimate analysis of clays; the proximate or "Rational" analysis of clays and pottery bodies. Five credit hours. Course in Ceramics, second year, third term, M., Tu., W., 1-4. ASSISTANT PROFESSOR BLEININGER.

4. Clay Manufacture. The origin, composition and properties of clays and other minerals employed in the clay, glass and cement industries. Five credit hours. Course in Ceramics, third year, first term; Short Course in Clay-working, second year, first term, M., Tu., W., Th., F., 8. Concurrent, Ceramics 1. PROFESSOR ORTON.



NEW CERAMICS AND MINING BUILDING.

5. Continuation of 4. General principles of the manufacture of clay wares, including the selection and winning of the materials, their preparation, manufacture and drying. Five credit hours. Course in Ceramics, third year; Short Course in Clay-working, second year, second term, M., Tu., W., Th., F., 8. PROFESSOR ORTON.

6. Continuation of 5. Burning and decoration of claywares, including the preparation of coloring materials, glazes, etc. Five credit hours. Course in Ceramics, third year; Short Course in Clay-working, second year, third term, M., Tu., W., Th., F., 8. PROFESSOR ORTON.

7. Ceramic Chemistry. The analysis of glasses and glazes, with special attention to the use of hydrofluoric acid in silicate analysis, and to the determination of the coloring oxides and boracic acid. Five credit hours. Course in Ceramics, third year, third term, M., Tu., W., 1-4. Prerequisite, Ceramics 3. ASSISTANT PROFESSOR BLEININGER.

9. Laboratory Work in Ceramics. Practice in clay testing and measurement of the physical properties of clays; the production of bodies made from single clays from the blending of two or more natural clays, and from clays and minerals other than clays. In each case the bodies made will be burnt and tested. Five credit hours. Course in Ceramics, fourth year, first term, W., Th., F., 1-4. Prerequisite, Ceramics 3 and 6. PROFESSOR ORTON, MR. PURDY.

10. Continuation of 9. The production of glasses and glazes, beginning with the soft raw-lead glazes, the fritted lead-boracic-acid glazes, and the hard-fire leadless porcelain glazes. In each case the glazes will be made for use on some definite body, and will be made to "fit." Five credit hours. Alternative with Ceramics 12. Course in Ceramics, fourth year, second term, W Th., F., 1-4. PROFESSOR ORTON, MR. PURDY.

11. Continuation of 10. Practice in the use of the coloring and opacifying oxides in glazes, and in the production of colors for the decoration of pottery and of body stains. Five credit hours. Alternative with Ceramics 18. Course in Ceramics, fourth year, third term, M., F., 8-12, F., 1-3. PROFESSOR ORTON, MR. PURDY.

12. Cement Manufacture. Lectures. The theory of hydraulicity, the compounding, manufacture and testing of natural and Portland cements and hydraulic silicates. Five credit hours. Alternative with Ceramics 10. Course in Ceramics, fourth year, second term, M., Tu., W., Th., F., 9. Prerequisite, Ceramics 3 and 6. ASSISTANT PROFESSOR BLEININGER.

15. Thesis.

16. General Principles of Applied Ceramics. Chemical technology of the clay, glass and cement industries. Five credit hours. Course in Chemical Engineering, fourth year, third term, M., Tu., W., Th., F., 9. Prerequisite, Chemistry 20. PROFESSOR ORTON.

18. Cement Manufacture. Laboratory. Training in the analysis of cement materials by the methods in technical use; in the preparation of minerals for cement; in the burning of cement; in the testing of the products, and in the investigation of the general problem of the cement manufacturer. Five credit hours. Alternative with Ceramics 11. Course in Ceramics, fourth year, third term, M., F., 8-12, F., 1-3. Prerequisite, Ceramics 12. ASSISTANT PROFESSOR BLEININGER.

19. Stoichiometry. Calculation of bodies and glazes and the combustion of the fuel necessary for work in driers and kilns. Five credit hours. Short course in Clay-working, second year, third term, M., Tu., W., Th., F., 11. Prerequisite, Ceramics 1 and 2. ASSISTANT PROFESSOR BLEININGER, MR. PURDY.

20. Laboratory Work in Ceramics. Testing of clays and minerals employed in clay manufacture. Two credit hours. Short course in Clay-working, second year, first term, Th., F., 1-4. Prerequisite, Chemistry 12a. Concurrent, Ceramics 1. PROFESSOR ORTON, MR. PURDY.

21. Laboratory Work in Ceramics. Compounding of artificial clay bodies and the blending of natural clays. Two credit hours. Short course in Clay-working, second year, second term, Th., F., 1-4. Prerequisite, Ceramics 20. PROFESSOR ORTON, MR. PURDY.

22. Physical Chemistry. The elementary conceptions of physical chemistry with special reference to the silicate industries. Three credit hours. Course in Ceramics, fourth year, second term, M., Tu., 1-4. Prerequisite, Ceramics 6 and 7. ASSISTANT PROFESSOR BLEININGER.

NEW CHEMICAL BUILDING. (From Architect's Perspective.)

23. Laboratory Work in Ceramics. The production of glazes of the types commonly used in the pottery and allied industries. Practice will be given in fitting glazes to some definite body. Seven credit hours. Short course in Clay-working, second year, third term, M., Tu., W., Th., F., 1-4. Prerequisite, Ceramics 2 and 5.

Chemistry

Temporary Office, Townshend Hall.

PROFESSOR McPHERSON, EMERITUS PROFESSOR NORTON, ASSOCIATE PROFESSOR HENDERSON, ASSOCIATE PROFESSOR FOULK, ASSISTANT PROFESSOR EVANS, *MR. HIRSCH, MISS ANDREWS, MR. STEWART, MR. WATKINS, MR. MOORE.

The laboratories of the department accommodate six hundred students. Each laboratory is equipped with all the necessary conveniences—water, gas, electric lights, distilled water piped from a large still in the attic, steam ovens, automatic air blasts, suction pumps, etc. The department is liberally supplied with the best apparatus and materials for both lecture room and laboratory work. Each student has his own desk with drawers and locker. All supplies are procured from the chemical store room, which has always on hand a complete stock of all necessary materials.

3. Elementary Chemistry. One lecture, one quiz and six hours laboratory work weekly. Five credit hours. This is an elementary course arranged for short course students. Short Course in Clay-working, first year; Short Course in Mining, second year; first and second terms, lecture M., 10, quiz Th., 8, laboratory M., Tu., 1-4.

7. Elementary Chemistry. Inorganic. One lecture, one quiz and six hours laboratory work weekly. Laboratory work; first term, experiments upon the non-metals; second term, experiments upon the metals. Five credit hours. All four-year courses, first year, first and second terms, lecture M. 8 or 3; quiz F. 9, 10, 1 or 3; laboratory M., Tu., 9-12; Th., F., 9-12; Th. F., 1-4; or W., 8-10, S., 8-12.

---

*Resigned.

8. Organic Chemistry. One lecture, one quiz, six hours laboratory work weekly. Five credit hours. Course in Chemical Engineering, third year, first term, Tu., Th., 8; M., Tu., 1-4. Prerequisite, Chemistry 20 and 21. PROFESSOR MCPHERSON.

9. Organic Chemistry. Five credit hours. Courses in Chemical Engineering, third year, second term, Tu., Th., 8; laboratory W., F., 1-4. Option, third term, Tu., Th., 8; M., F., 1-4. Prerequisite, Chemistry 8. PROFESSOR MCPHERSON.

12. Qualitative Analysis. One recitation and six hours laboratory work weekly. Four credit hours. All four-year courses, first year, third term. For hours see Course 7, omitting lecture. Prerequisite, Chemistry 7.

12a. Qualitative Analysis. Two recitations and six hours laboratory work weekly. Five credit hours. Course in Clay-working, first year, third term, M., 10, F., 10, M., Tu., 1-4. Prerequisite, Chemistry 3.

15. Sanitary Chemistry. Two lectures and four hours laboratory work weekly. A study of the most important chemical methods for the analysis of water. Four credit hours. Course in Chemical Engineering, fourth year, third term, Tu., Th., 10, F., 1-5. Prerequisite, Chemistry 20. ASSOCIATE PROFESSOR FOULK.

20. Quantitative Analysis. One lecture and six hours laboratory work weekly. Principles of gravimetric and volumetric analysis. Four credit hours. Course in Chemical Engineering, second year, first, second and third terms, M., Tu., 1-4, W., 1-3. Course in Manual Training, third year, option. Prerequisite, Chemistry 12; concurrent, Chemistry 21 and 40. ASSOCIATE PROFESSOR FOULK.

21. Advanced General Chemistry. Two lectures weekly. A thorough study of the principles of general inorganic chemistry, paying especial attention to chemical theory. Two credit hours. Course in Chemical Engineering, second year; option, course in Manual Training, third year; first, second and third terms, Tu., Th., 9. Prerequisite, Chemistry 12; concurrent, Chemistry 20. ASSOCIATE PROFESSOR HENDERSON.

30. Physical Chemistry. Three lectures weekly. A general study of the principles of Chemistry. Three credit hours. Course in Chemical Engineering, fourth year, second and third terms, M., W., F., 8. Prerequisite, Chemistry 9, 20 and 21.

CLASS IN RAILROAD SURVEYING.

32. Industrial Chemistry. Two lectures and four hours laboratory work weekly. Four credit hours. Course in Chemical Engineering, fourth year, first and second terms, Tu., Th., 8, W., Th., 1-3. Prerequisite, Chemistry 9, 20 and 21. ASSOCIATE PROFESSOR HENDERSON.

35. Rare Elements. Three lectures weekly. A study of those elements usually passed by with brief comment in general courses. It is of considerable practical value to students of metallurgy, since many of the rarer metals are now frequently met with in the metallurgical industries, and the analyst must be familiar with their properties. Three credit hours. Option, Course in Chemical Engineering, fourth year, first term, M., W., F., 8. Prerequisite, Chemistry 20 and 21. ASSOCIATE PROFESSOR HENDERSON.

40. Stoichometry. Drill in the solution of chemical problems. One credit hour. Course in Chemical Engineering, second year, second and third terms, Th., 11. Prerequisite, Chemistry 12. ASSOCIATE PROFESSOR FOULK.

Civil Engineering

Office, Brown Hall, Room, 33.

PROFESSOR SHERMAN, PROFESSOR HELLER, PROFESSOR ENO, *ASSISTANT PROFESSOR BRUNING, MR. CHAMBERLIN, MR. WARD.

The department is housed in Brown Hall. For drafting, three spacious and well-lighted drawing rooms are provided for the work of the second, third, and fourth year students respectively. In each room is a collection of working drawings, prints, maps, etc., gathered from practicing engineers, and arranged in suitable file-cases for the ready consultation of the students. A large blue-print room on the ground floor is equipped with electrical blue-print apparatus, in addition to the ordinary sunlight frames.

For field work the instruments are one high grade transit, ten other transits fitted for various kinds of surveying, six leveling instruments, solar compass, two solar attachments, two high-grade aneroid barometers, two drainage levels, surveying camera, rods, chains, tapes, hand-levels, etc. Two current meters with accessories, and a rating course 175 feet long in the rear of the building furnish facilities for carrying on hydrographic work.

The cement-testing laboratory is fitted with necessary appliances

---

*Resigned.

for making the ordinary tests. It contains a Fairbanks testing machine, briquette moulds, sieves, apparatus for making hot test, etc., and machine for testing plain and reinforced concrete beams.

The department also owns a complete outfit for carrying on the work of summer surveying in camp. Summer camp for 1903 was pitched in the heart of the mountains of southeastern Kentucky, for the survey of an extensive tract of coal lands. Summer camp for 1905 will be pitched in Yellowstone National Park, where the classes will be engaged in the surveying of the road system.

1. Land Surveying. Recitations and field work. Johnson's Theory and Practice of Surveying. Six credit hours. Course in Civil Engineering, second year, first term, M., Tu., W., Th., F., 11 or 1. Field work, M., Tu., W. or F., 2-4, or S., 8-10. Prerequisite, Mathematics 14 or 32. PROFESSOR SHERMAN, PROFESSOR ENO, ASSISTANT PROFESSOR BRUNING, MR CHAMBERLIN, MR. WARD.

2. Railroad Surveying. Recitations and field work. Searles' Field Engineering and Crandall's Transition Curve. Six credit hours. Course in Civil Engineering, second year, third term, M., Tu., W., Th., F., 11 or 1. Field work, M., Tu., W. or F., 2-4, or S., 8-10. Prerequisite, Civil Engineering 1. PROFESSOR SHERMAN, PROFESSOR ENO, ASSISTANT PROFESSOR BRUNING, MR CHAMBERLIN, MR. WARD.

3. Topographic Surveying. Lectures, field work, and drawing. Johnson's Surveying used for reference. Four credit hours. Course in Civil Engineering, third year, first term, M., F., 10, Tu., Th., 2-5; or Tu., Th., 10, M. and W. or F., 2-5. Prerequisite, Civil Engineering 2 and 22. PROFESSOR SHERMAN, ASSISTANT PROFESSOR BRUNING, MR. CHAMBERLIN.

4. Topographic Drawing. Platting, pen and tinted work. Reed's Topographical Drawing and Sketching. Four credit hours. Course in Civil Engineering, second year, second term, M., Tu., 1-4, W., 1-3; or Th., F., 2-4, S., 8-12. Prerequisite, Drawing 26 and 32. PROFESSOR SHERMAN, PROFESSOR ENO.

6. Stereotomy. Recitations, lectures and drawing. Warren's Stereotomy. Four credit hours. Courses in Architecture and Civil Engineering, third year, second term, M., F., 10, S., 8-12; or Tu., Th., 10, S., 8-12. Prerequisite, Drawing 36. PROFESSOR SHERMAN, ASSISTANT PROFESSOR BRUNING.

7. Bridge Stresses. Recitations and lectures. Heller's Stresses in Structures. Five credit hours. Course in Civil Engineering, third year, third term, M., Tu., W., Th., F., 8, or 9. Prerequisite, Mathematics 72. PROFESSOR HELLER.

8. Bridge Designing. Lectures and drawings. Heller's Notes and Johnson's Modern Framed Structures used for reference. Five credit hours. Course in Civil Engineering, fourth year, first term, M., Tu., W., Th., F., 8. Prerequisite, Civil Engineering 7. PROFESSOR HELLER.

10. Sanitary Engineering. Recitations and lectures. Folwell's Sewerage. Five credit hours. Course in Civil Engineering, fourth year, third term, M., Tu., W., Th., F., 9. Prerequisite, Civil Engineering 15. PROFESSOR ENO.

14. Civil Engineering Laboratory. Cement testing. Two credit hours. Course in Civil Engineering, fourth year, second term, M., 1-4, Tu., 1; or Tu., 1-4, W., 1. Prerequisite, Civil Engineering 15. PROFESSOR ENO.

15. Masonry Construction. Recitations and lectures. Baker's Masonry Construction. Five credit hours. Courses in Architecture and Civil Engineering, fourth year, first term, M., Tu., W., Th., F., 9. Prerequisite, Mathematics 72. PROFESSOR SHERMAN.

16. Highways. Recitations and lectures. Baker's Roads and Pavements. Five credit hours. Course in Civil Engineering, third year, first term, M., Tu., W., Th., F., 8 or 9. Prerequisite, Civil Engineering 2. PROFESSOR ENO.

17. Railway Location. Recitations and lectures. Wellington's Economic Theory of Railway Location. Five credit hours. Option, course in Civil Engineering, fourth year, second term, M., Tu., W., Th., F., 9. Prerequisite, Civil Engineering 15. PROFESSOR SHERMAN.

18. Water Supply. Recitations and lectures. Turneaure and Russell's Public Water Supplies. Five credit hours. Course in Civil Engineering, fourth year, third term, M., Tu., W., Th., F., 8. Prerequisite, Civil Engineering 15. PROFESSOR ENO.

19. Trusses. Lectures and drawings. Five credit hours. Courses in Architecture, Mining and Mechanical Engineering, third year, third term, M., Tu., Th., F., 10, W., 2; or M., Tu., W., Th., F., 11. Prerequisite, Mathematics 72. PROFESSOR HELLER.

21. Surveying. Recitations, lectures and field work. Three credit hours. Courses in Architecture and Industrial Arts, fourth year, third term, M., W., F., 9. Prerequisite, Drawing 32 and Mathematics 14 or 32. PROFESSOR SHERMAN, MR. CHAMBERLIN, MR. WARD.

22. Summer Course in Field Work. The students are taken into camp in a rough, broken country and given a thorough drill in land and elementary railroad surveying. The course begins the Friday before Commencement Day, and continues four weeks of six days per week, ten hours per day. The work of the student and discipline of the camp is in the hands of competent instructors. At conclusion of second year of Course in Civil Engineering. Prerequisite, Civil Engineering 2 and 4. PROFESSOR SHERMAN, PROFESSOR ENO, ASSISTANT PROFESSOR BRUNING, MR. CHAMBERLIN, MR. WARD.

23. Summer Course in Field Work. Similar to Course 22. Students work on advanced railroad surveying and topographical surveying. At conclusion of third year of Course in Civil Engineering. Prerequisite, Civil Engineering 3, 22 and 24.

24. Drawing of Engineering Structures. Five credit hours. Course in Civil Engineering, third year, second term, M., Tu., W., 1-4; or W., Th., F., 1-4. Prerequisite, Drawing 35 and Mathematics 71. PROFESSOR SHERMAN, ASSISTANT PROFESSOR BRUNING.

25. Advanced Bridge Work. Draw-spans, continuous girders, steel arches, etc. Five credit hours. Option, Course in Civil Engineering, fourth year, second term, M., Tu., W., Th., F., 8. Prerequisite, Civil Engineering 8. PROFESSOR HELLER.

27. Timber and Masonry. Lectures and recitations. Use of stone, brick, lime, cement, timber, etc., in engineering structures. Three credit hours. Courses in Industrial Arts and Mechanical Engineering, third year, last three-fifths of second term, M., Tu., W., Th., F., 9. Concurrent, Industrial Arts 4 or Mathematics 72. ASSISTANT PROFESSOR BRUNING.

28. Steel Construction. Steel skeleton construction for tall buildings. Five credit hours. Course in Architecture, fourth year, second term, M., Tu., W., Th., F., 9. Prerequisite, Civil Engineering 19. PROFESSOR HELLER.

29. Cement Testing. Three credit hours. Course in Architecture, fourth year, second term, Tu., W., 1-4. Prerequisite, Civil Engineering 15. PROFESSOR ENO.

Drawing

(DEPARTMENT OF ARCHITECTURE AND DRAWING.)

Office, Brown Hall, Room 42.

PROFESSOR BRADFORD, ASSOCIATE PROFESSOR FRENCH, ASSISTANT PROFESSOR LEWIS, *ASSISTANT PROFESSOR VOSSKUEHLER, MR. MARTIN, MR. TIDBALL, MR. ROGERS.

2. Lettering. Practice and occasional lectures. Three credit hours. Short Courses in Clay Working and Industrial Arts, first year; Short Course in Mining, second year, first term, Th., F., 1-4. Concurrent, Drawing 24 or 27. MR. ROGERS.

5. Technical Drawing. Rules and methods for making working drawings in machine design to represent correctly form and dimensions for shop use, and for tracing and blue-printing the same. Three credit hours. Courses in Electrical and Mechanical Engineering, Industrial Arts and Manual Training, third year, first term, M., Tu., 1-4, or Th., F., 1-4. Prerequisite, Drawing 35. ASSOCIATE PROFESSOR FRENCH, ASSISTANT PROFESSOR VOSSKUEHLER.

7. Photography. Lectures: Optics of photography, chemistry of photography, exposing and developing, printing, lantern slides, orthochromatic photography and some of the applications of photography. Practice: Outdoor, interior and instantaneous photography, copying, lantern slides and printing. Two credit hours. Courses in Architecture, third year; Course in Ceramics, fourth year, first term, M., Tu. 1-3. Course in Civil and Mechanical Engineering, third year; Course in Mining Engineering, fourth year, third term, M., Tu., 1-3 or Th., F., 1-3. Prerequisite, Chemistry 7 and Physics 2. PROFESSOR BRADFORD, ASSISTANT PROFESSOR LEWIS.

14. Pen Drawing. Two credit hours. Course in Architecture, second year, first term, M., Tu., 2-4. Prerequisite, Drawing 26. ASSISTANT PROFESSOR LEWIS.

---

*Resigned.

18. Water Color Painting. Two credit hours. Course in Architecture, third year, second term, Tu., Th., 9-11. Prerequisite, Drawing 26. MR. MARTIN.

19. Water Color Painting. Three credit hours. Course in Architecture, third year, third term, Tu., Th., 8-10, M., 1-3. Prerequisite, Drawing 18. MR. MARTIN.

21. Technical Drawing. Two credit hours. Course in Chemical Engineering, third year, first term, W., F., 8-10. ASSISTANT PROFESSOR VOSSKUEHLER.

22. Technical Drawing. Two credit hours. Course in Chemical Engineering, third year; Course in Ceramics, fourth year, second term, S., 8-12. Prerequisite, Drawing 21 or 39.

23. Technical Drawing. Two credit hours. Course in Chemical Engineering, third year; Course in Ceramics, fourth year, third term, S., 8-12. Prerequisite, Drawing 22.

24. Free Hand Drawing. Pencil drawing from models and plaster casts. Practice and occasional lectures. One credit hour. Short Course in Industrial Arts, first year, first term, W., 1-3. MR. MARTIN.

25. Free Hand Drawing. Brush work from models and plaster casts. Practice and occasional lectures. One credit hour. Short Course in Industrial Arts, first year, second term, W., 1-3. All four-year courses, first year, second term. Prerequisite, Drawing 24 or 27. ASSISTANT PROFESSOR LEWIS, MR. MARTIN, MR. TIDBALL.

26. Free Hand Drawing. Pen work from plaster casts and still-life. Practice and occasional lectures. One credit hour. Short Course in Industrial Arts, first year, third term, W., 1-3. All four-year courses, first year, third term. Prerequisite, Drawing 25.

27. Free Hand Drawing. Pencil drawing from models and plaster casts. Practice and occasional lectures. Two credit hours. Short Course in Mining, second year, first term, W., F., 8-10. All four-year courses, first year, first term.

31. Geometric Drawing. Practice in the use of drawing instruments. One credit hour. All four-year courses, first year, second term. ASSOCIATE PROFESSOR FRENCH, ASSISTANT PROFESSOR VOSSKUEHLER, MR. ROGERS.

32. Lettering. Practice and occasional lectures. Two credit hours. All four year courses, first year, third term. Prerequisite, Drawing 31.

33. Projection Drawing. Lectures and practice. Orthographic, isometric and oblique projections, and elementary working drawings. Three credit hours. Second year, first term.

Lectures	Practice.	Course in
M., 8	Tu., Th., 9-11	Architecture.
W., 11	M., F., 10-12	Ceramics.
W., 11	M., F., 10-12	Chemical Engineering.
M., 8	Tu., Th., 9-11	Civil Engineering.
W., 11	M., F., 10-12	Electrical Engineering
W., 11	M., F., 10-12	Industrial Arts.
M., 8	M., F., 10-12	Manual Training.
Tu., 9	M., F., 10-12	Mechanical Engineering.
Tu., 11	Tu., Th., 9-11	Mining Engineering.

Prerequisite, Drawing 2 or 32. Associate Professor French. Assistant Professor Vosskuehler.

34. Descriptive Geometry. Lectures and practice. Three credit hours. Second year, second term.

Lectures.	Practice.	Course in
M., W., 11	F., 10-12	Ceramics.
M., W., 11	F., 10-12	Chemical Engineering.
M., W., 11	F., 10-12	Electrical Engineering.
M., W., 11	F., 10-12	Industrial Arts.
M., W., 8	F., 10-12	Manual Training.
Tu., Th., 9	F., 10-12	Mechanical Engineering.
M., W., 11	Tu., 9-11	Mining Engineering.
M., W., 8	Tu., 9-11	Short Industrial Arts.

Prerequisite, Drawing 33 or 38.

35. Shades, Shadows and Perspective. Three credit hours, second year, third term.

Lectures	Practice.	Course in
M., 8	Tu., Th., 9-11	Civil Engineering.
W., 11	M., F., 10-12	Electrical Engineering
W., 11	M., F., 10-12	Industrial Arts.
M., 8	M., F., 10-12	Manual Training.
Tu., 9	M., F., 10-12	Mechanical Engineering.
Tu., 11	Tu., Th., 9-11	Mining Engineering.
M., 8	Tu., Th., 9-11	Short Industrial Arts.

Prerequisite, Drawing 34 or 36.

36. Descriptive Geometry. Five credit hours. Courses in Architecture and Civil Engineering, second year, second term, M., W., 8, Tu., Th., 8-11. Prerequisite, Drawing 33 or 38. PROFESSOR BRADFORD.

37. Architectural Perspective and Shades and Shadows. Lectures and practice. Five credit hours. Course in Architecture, second year, third term, Tu., Th., 8-12. Prerequisite, Drawing 36. Concurrent, Architecture 14.. PROFESSOR BRADFORD.

38. Projection Drawing. Lectures and practice. Orthographic, isometric and oblique projections and intersections. Three credit hours. Short Courses in Clay Working and Industrial Arts, first year; Short Course in Mining, second year, second term, Th., 1-4, F., 1-3. Prerequisite, Drawing 2 or 32. MR. ROGERS.

39. Draughting and Blue-Printing. Practice and occasional lectures. Three credit hours. Short Courses in Clay Working and Industrial Arts, first year; Short Course in Mining and Course in Ceramics, second year, third term, Th., F., 1-4. Prerequisite, Drawing 33 or 38. ASSISTANT PROFESSOR VOSSKUEHLER, MR. ROGERS.

40. Clay Modeling. Modeling in clay, ornamental forms from plaster casts, photographs and nature. Two credit hours. Course in Architecture, third year, second term, M., Tu., 1-3. Prerequisite, Drawing 26. ASSISTANT PROFESSOR LEWIS.

41. Clay Modeling. Modeling in clay and wax from photographs, nature and original designs. Casts made in plaster and gelatine molds. Two credit hours. Course in Architecture, third year, third term, M., Tu., 1-3 or Tu., 1-5. Prerequisite, Drawing 40. ASSISTANT PROFESSOR LEWIS.

Economics

(DEPARTMENT OF ECONOMICS AND SOCIOLOGY.)

Office, University Hall, Room 18.

PROFESSOR HAGERTY.

30. Industrial and Social History of England. Three credit hours. Course in Industrial Arts, second year, first term, M., W., F., 8.

31. Industrial and Social History of the United States. Three credit hours. Course in Industrial Arts, second year, second term, M., W., F., 8.

32. Commercial Geography. A study of the development and present economic status of roads, canals and railroads in their relation to industry and to the state. Three credit hours. Course in Industrial Arts, second year, third term, M., W., F., 8.

33. Elements of Political Economy. A careful study of the laws of production, exchange, distribution and consumption of wealth; combined with an analysis of the industrial actions of men as regards land, labor, capital, money, credit, rent, interest, wages, etc. Three credit hours. Course in Industrial Arts, third year, three terms, M., W., F., 8.

34. Immigration and Money. Two credit hours. Course in Industrial Arts, fourth year, first term, Tu., Th., 9. Prerequisite, Economics 33. Not given in 1905-6.

35. Railroads, Crisis, Tariff. Two credit hours. Course in Industrial Arts, fourth year, second term, Tu., Th., 9. Prerequisite, Economics 34. Not given in 1905-6.

36. Labor and Capital. Two credit hours. Course in Industrial Arts, fourth year, third term, Tu., Th., 9. Prerequisite, Economics 35. Not given in 1905-6.

Education

Office, University Hall, Room 54.

Professor Major, Dr. Haines.

1. Educational Psychology. A thorough study of laws and principles selected from psychological literature on educational theory and practice. The function of psychology in determining the selection and arrangement of school studies and its bearing on class room procedure. James' Talks on Psychology supplemented by references to standard texts and to periodicals on psychology and education. Three credit hours. Course in Manual Training, second year, first, second and third terms, M., W., F., 11.

5. Science of Education. The foundations of educational theory; especially intended for the student who expects to deal with the larger problems of education which confront superintendent or principal. Lectures, required readings and reports. Three credit hours. Course in Manual Training, fourth year, first, second and third terms, M., W., F., 11.

Electrical Engineering

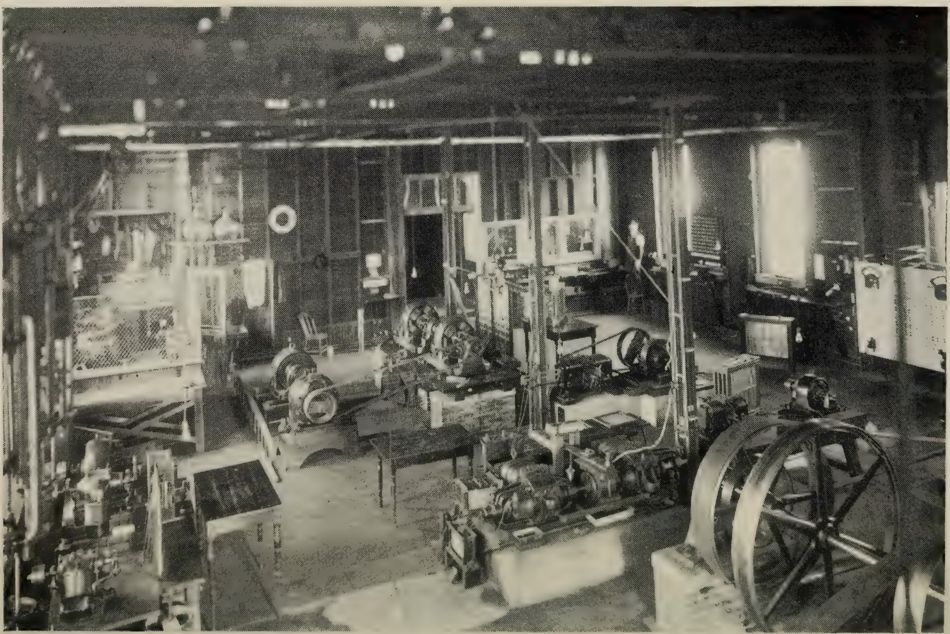
Office, Electrical Building, Room 8.

PROFESSOR CALDWELL, ASSOCIATE PROFESSOR ANDEREGG, ASSISTANT PROFESSOR COGGESHALL.

This department has excellent facilities for practical experimental work with dynamo machinery and other electrical apparatus. The dynamo equipment consists of twenty-three machines of various makes and sizes from 40-H. P. down, aggregating over 250 horsepower. These include 110 and 500 volt direct and alternating current generators, railway and stationary motors, polyphase motors, three rotary converters specially designed for experimental work, and a unipolar dynamo. There are also a number of transformers of different makes, including one for welding, one for very high voltage and six of special design for testing. Arc lamps of different styles, a storage battery, condensers, resistances, circuit breakers and apparatus for magnetic testing, illumination testing and photometric work also form part of the equipment. The measuring instruments include a standard Weston voltmeter with standard resistances and cells, besides over thirty-five other voltmeters and ammeters, mostly Weston's, and three wattmeters. There is a telephone laboratory with apparatus for comparative tests, a variety of transmitters and receivers, and material illustrative of switch-board practice.

Power for running the dynamo laboratory is supplied from the University Power Plant by five induction motors and two synchronous motors or converters. There is also a well-selected and growing collection of photographs, blue-prints and material illustrative of electrical manufacture. The library of the Department is especially valuable on account of the completeness of its sets of periodicals and transactions. The University Power Plant is of great value as illustrative of a model installation.

6. Electrical Engineering. Lectures on direct and alternating circuits, dynamo machinery, transformers, accumulators and their applications. Two credit hours. Courses in Civil, Mechanical and Mining Engineering, Industrial Arts and Manual Training, fourth year, first and second terms; Course in Chemical Engineering, fourth year, first term, M., Th., 10. Prerequisite, Physics 2. ASSOCIATE PROFESSOR ANDEREGG.



ELECTRICAL LABORATORY.

THE
JOHN CRERAR
LIBRARY

7. Electrical Engineering. Laboratory work on the subjects treated in 6. Two credit hours. Fourth year. ASSOCIATE PROFESSOR ANDEREGG, ASSISTANT PROFESSOR COGGESHALL.

First term—M., 1-5. Course in Chemical Engineering.
W., 1-5. Course in Industrial Arts.
S., 8-12. Course in Manual Training.
W., 1-5 or S., 8-12. Course in Mechanical Engineering.
M., 1-5. Course in Mining Engineering.

Second term—M. or W,. 1-5. Course in Civil Engineering.
Th., 1-5. Course in Industrial Arts.
Th., 1-5. Course in Manual Training.
F., 1-5 or S., 8-12. Course in Mechanical Engineering.
M., 1-5 or S., 8-12. Course in Mining Engineering.

8. Direct Current Dynamo Machinery. Generators and motors, their theory, construction and operation. Lectures, recitations and problems. Four credit hours. Course in Electrical Engineering, third year, second term, M., Tu., Th., F., 9. Prerequisite, Physics 4. Concurrent, Physics 6. ASSOCIATE PROFESSOR ANDEREGG.

9. Elementary Dynamo Laboratory. Handling and testing of circuits, generators, motors, etc. Four credit hours. Course in Electrical Engineering, third year, third term, W., Th., 1-5; or F., 1-5, S., 8-12. Prerequisite, Electrical Engineering. ASSOCIATE PROFESSOR ANDEREGG, ASSISTANT PROFESSOR COGGESHALL.

11. Advanced Dynamo Laboratory. Alternate current, railway and telephone apparatus, accumulators, illumination, etc. Three credit hours. Course in Electrical Engineering, fourth year, first and second terms, Tu. or Th., 10-5; third term, M. or Tu., 10-5. Prerequisite, Electrical Engineering 15. Concurrent, 16 and 17. PROFESSOR CALDWELL, ASSISTANT PROFESSOR COGGESHALL.

12. Electrical Transmission and Distribution. Systems, operation and apparatus. Two credit hours. Course in Electrical Engineering, fourth year, second term, Tu., Th., 8. Prerequisite, Electrical Engineering 8. PROFESSOR CALDWELL.

13. Application of Electricity. Brief treatment of the elements of illumination, street railway work, telephone, telegraph, electrometallurgy, mining, etc. The seminary method is used in this course to the extent of each student writing one paper on some assigned subject, and reading the same before the class. Five credit hours. Course in Electrical Engineering, fourth year, third term, M., Tu., W., Th., F., 8. Prerequisite, Electrical Engineering 8. PROFESSOR CALDWELL, ASSOCIATE PROFESSOR ANDEREGG.

15. Alternating Current Circuits and Machinery. Systems, generators and transformers. Two credit hours. Course in Electrical Engineering, third year, third term, M., Th., 10. Concurrent, Electrical Engineering 9. PROFESSOR CALDWELL.

16. Continuation of 15. Synchronous and induction motors, etc. Three credit hours. Course in Electrical Engineering, fourth year, first term, M., W., F., 11. Concurrent, Electrical Engineering 11. PROFESSOR CALDWELL.

17. Continuation of 16. Two credit hours. Course in Electrical Engineering, fourth year, second term, M., W., 8. Concurrent, Electrical Engineering 11. PROFESSOR CALDWELL.

18. Electrical Design. Direct and alternate current generators, transformers, distribution, wiring of buildings, etc. Three credit hours. Course in Electrical Engineering, fourth year, second term, F., 1-4, S., 8-11. Prerequisite, Drawing 5. Concurrent, Industrial Arts 9. ASSISTANT PROFESSOR COGGESHALL.

19. Continuation of 18. Four credit hours. Course in Electrical Engineering, fourth year, third term, W., Th., 1-5. ASSISTANT PROFESSOR COGGESHALL.

20. Inspection Trip to the East, including Pittsburg, Buffalo, Niagara, Cleveland, and possibly other places, taken at the end of the winter term, occupies six days and is open to third and fourth year students. The entire expense need not exceed $30.00. A satisfactory written report upon the work of the trip is required. Given only in the even years. Required in the Course in Electrical Engineering, third or fourth year.

21. Inspection Trip to the West, including Chicago, Milwaukee, Cincinnati, and possibly other places, taken at the end of the winter term, occupies six days, and is open to third and fourth year students. The entire expense need not exceed $30.00. A satisfactory written report upon the work of the trip is required. Given only in the odd years. Required in the Course in Electrical Engineering, fourth or third year.

22. A satisfactory written report on a course of assigned reading upon processes of manufacture and power plants may be taken by third and fourth year students in the Course in Electrical Engineering as a substitute for 20, on presentation of satisfactory reasons to the head of the department.

23. Similar to 22. As a substitute for 21.

English

Office, University Hall, Room 44.

Professor Denney, Professor Barrows, Associate Professor Taylor, Assistant Professors Graves and McKnight.

1. Paragraph Writing and Analysis of Prose. Writing of short themes, outlining and composition of essays and speeches and the study of illustrative texts for structure and form. Two credit hours. All four-year courses, first year, first, second and third terms, Tu., Th., 8; W., F., 8; or Tu., Th., 9 or 10.

2. Expository Writing. Composition and analysis of various types of essays. Two credit hours. Courses in Industrial Arts, Manual Training, and Electrical and Mechanical Engineering, second year; Courses in Architecture, Ceramics and Chemical, Civil and Mining Engineering, third year, first term, M., F., 10; or Tu., Th., 10; or Tu., Th., 11; or W., F., 1. Prerequisite, English 1.

3. Brief-Making and Written Argumentation. Principles of logical analysis, evidence and argumentation, writing briefs of noted speeches, preparation of original briefs with written argumentation. Two credit hours. Courses and years as in 2. Second term, M., F., 10; Tu., Th., 10; or Tu., Th., 11. Third term, M., F., 10; or Tu., Th., 10. Prerequisite, English 1.

French

(DEPARTMENT OF ROMANCE LANGUAGES AND LITERATURES.)

Office, University Hall, Room 35.

PROFESSOR BOWEN, ASSOCIATE PROFESSOR BRUCE, ASSISTANT PROFESSOR INGRAHAM, MISS JACKSON.

1. Elementary French. Grammar and reader, modern prose and plays. Four credit hours. First, second and third terms, M., Tu., Th., F., 10 or 11, or Tu., W., Th., F., 2 or 3. Required of all students who offer partial credit in French as their entrance language. Offered as alternative with German 1 and Spanish 1 to those who enter with full or partial credit in Latin or Greek, or without previous language training.
2. Modern French Literature. Reading and prose composition, syntax and idioms. Four credit hours. First and second terms, M., Tu., Th., F., 10 or 11; or Tu., W., Th., F., 2. Required of all students who offer only French as their modern language for entrance. Prerequisite, French 1. PROFESSOR BOWEN, ASSOCIATE PROFESSOR BRUCE.
3. Science Reading. Four credit hours. Third term, M., Tu., W., Th., 9. Required of all students who offer only French as their modern language for entrance. Prerequisite, French 2. ASSISTANT PROFESSOR INGRAHAM.

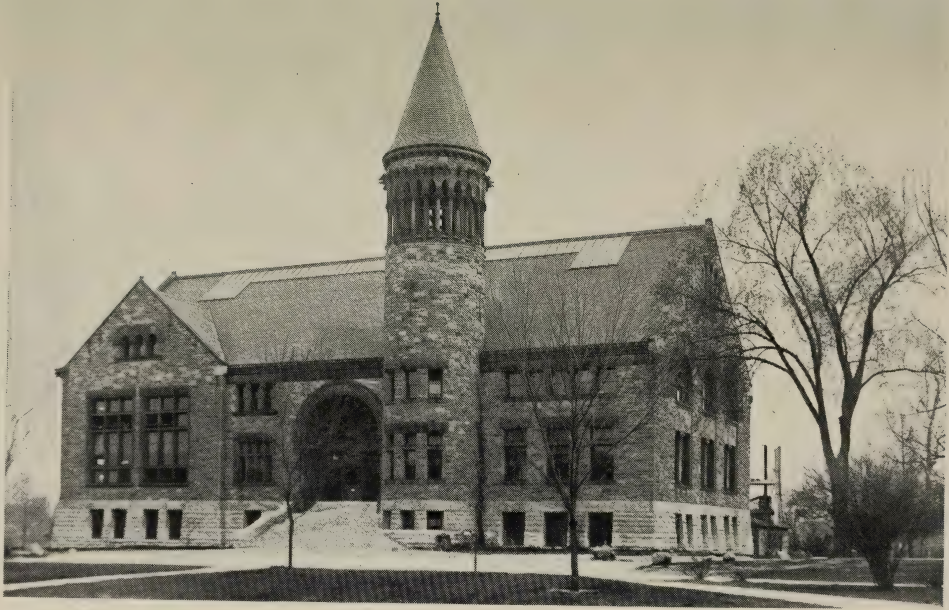
Geology

Office, Orton Hall, Room 1.

PROFESSOR PROSSER, PROFESSOR BOWNOCKER.

By an act of the Legislature, the University has been put in possession of all the collections made by the geological survey, and these have been supplemented by valuable additions of fossils and minerals from various sources. The State collection embraces a very complete representation of every geological formation shown in Ohio. Exceptionally good opportunities exist for work in the lithological and stratigraphical laboratories.

Orton Hall is designed for the permanent accommodation of these large geological collections and for work and instruction in the Department of Geology. The building is built of brick and faced with sandstone. Some of the material was contributed by various



ORTON HALL.

quarries of the State of Ohio, and almost all of the finer varieties of Ohio building stone are represented in the columns, walls and ceiling panels of the vestibule.

1. Physiography. The topographic features of the earth's surface and the agencies producing these. The atmosphere, climate, etc. Oceans, rivers and lakes. Recitations, lectures, map work. Five credit hours. Short Course in Mining, first year; Short Course in Industrial Arts, second year; third term, M., Tu., W., Th., F., 11. PROFESSOR BOWNOCKER.

2. General Geology. Structural, historical and dynamical geology. Four hours lectures and recitations, and two hours laboratory and field work. In the laboratory Dana's Manual of Geology, the Ohio Geological Reports and characteristic fossils will be studied. In the field, specimens will be collected, sections measured, formations identified and the student given an idea of the methods of work pursued by a field geologist. Field trips, mainly on Saturdays. Five credit hours. Courses in Architecture, Ceramics, Civil and Mining Engineering, fourth year, first term, M., Tu., W., Th., F., 11. PROFESSOR PROSSER.

4. Elementary Geology. Lithological, dynamical, structural and historical geology. Recitations, lectures, laboratory work. Five credit hours. Short Course in Mining, second year, second term, M., Tu., W., Th., F., 9. PROFESSOR PROSSER, PROFESSOR BOWNOCKER.

6. Economic Geology. The nature of ores, their classification and origin. The metals of the United States, their distribution, abundance, modes of occurrence and origin. The non-metals, coal, oil, gas, clay, lime, cement, building stone, etc. In the discussion of the non-metals emphasis will be laid on the products of Ohio. Three credit hours. Courses in Ceramics, Civil and Mining Engineering, fourth year, second term, M., W., F., 11. Prerequisite, Geology 2. PROFESSOR BOWNOCKER.

7. Petrography. The igneous, sedimentary and metamorphic rocks—their origin and classification. The volcanic rocks of the Western United States—their composition, structure and alteration products. The object of this course is to give the student a practical acquaintance with rocks. Two credit hours. Courses in Ceramics and Mining Engineering, fourth year, second term, Tu., F., 10. Concurrent, Geology 6. PROFESSOR BOWNOCKER.

German

(DEPARTMENT OF GERMANIC LANGUAGES AND LITERATURES.)

Office, University Hall, Room 30.

PROFESSOR RHOADES, ASSISTANT PROFESSOR VILES, MR. EISENLOHR.

1. Elementary German. Four credit hours. First, second and third terms, M., Tu., Th., F., 10 or 11, or Tu., W., Th., F., 2 or 3. Required of all students who offer partial credit in German as their entrance language. Offered as alternative with French 1 and Spanish 1 to all students who enter with full or partial credit in Latin or Greek, or without previous language training.

2. Science Reading. Four credit hours. Third term, M., Tu., W., Th., 8. Required of all students who offer only German as their modern language for entrance. Prerequisite, German 4.

4. Intermediate German. Review of grammar. Reading of descriptive and narrative prose, with prose composition. Four credit hours. First and second terms. Required of all students who offer only German as their modern language for entrance. Prerequisite, German 1.

Gymnasium

(DEPARTMENT OF PHYSICAL EDUCATION.)

Office, Gymnasium.

DR. HUDDLESON.

The Gymnasium is a large modern building. Its basement is used for lockers, dressing rooms and baths. The east end is used by the young women, the west end by the young men. Each end has separate shower and plunge baths. The exercising floor, 80x150 feet, is thoroughly equipped with the best apparatus in duplicate. The running track is fourteen laps to the mile.

A thorough physical examination of each student is made in the fall and spring. The measurements are outlined on charts, so as to show the parts below the normal development, for which special exercise suited to the health and physical condition of each individual will be suggested. These charts are constructed from the accumulated data of several thousand measurements of students.

Class leaders are selected from among those who show proficiency in the work. After two years' service those of the leaders

THE ARMORY AND GYMNASIUM.

THE
[illegible]
[illegible]

GYMNASIUM—INTERIOR.

showing most capability are given a certificate of their appointment as Student Aides and the letter "A" in scarlet, which they are entitled to wear on their gymnasium suits.

It is the aim of the department to secure health, vigor and such harmonious development of the body as will fit it to resist disease, and prepare it for efficient service, both now and later in life.

Gymnasium. The course consists of theoretical and practical work in the gymnasium, and includes calisthenics, light and heavy gymnastics, physiology of exercise, physical examinations and measurements. Two hours a week for one term each year is required of all first and second year students.

History

(DEPARTMENT OF AMERICAN HISTORY AND POLITICAL SCIENCE.)

Office, University Hall, Room 15.

PROFESSOR KNIGHT, ASSISTANT PROFESSOR TUTTLE.

1. Political History of the United States. Text-books and prescribed reading. Thwaites's The Colonies; Hart's Formation of the Union; Wilson's Division and Re-Union. Three credit hours. Course in Manual Training, third year, first, second and third terms, M., W., F., 8 or 9.

Industrial Arts

Office,, Hayes Hall, Room 2.

PROFESSOR SANBORN.

The shops in Hayes Hall afford excellent facilities for instruction in both the practical details and the underlying principles of carpentry, pattern-making, forging, moulding, founding and machine work.

The carpenter and pattern shop contains twenty-five benches with complete sets of carpenter tools, twenty-three turning lathes, eight-foot pattern-maker's lathe with compound rest, pony planer, buzz planer, circular saw, scroll saw, 36-inch band saw, trimmer and power grindstone.

The forge shop has twenty stationary forges, with anvils and tools; heating forge, four blacksmith's vises, foot-power hammer, blacksmith's drill and punch, shear and bar cutter. The blast and exhaust fans are driven by an electric motor.

The foundry has a 24-inch Colliau cupola; two brass furnaces, core oven, space for floor moulding 30 feet by 40 feet, and the necessary moulding tools, flasks, crucibles, ladles, tongs, etc.

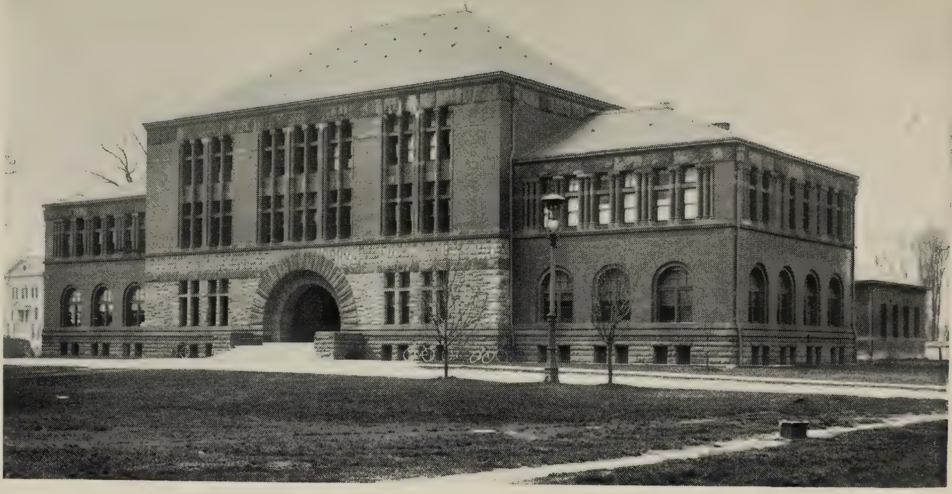
The machine shop is driven by an electric motor from above, and is equipped with twenty-eight benches for vise work with complete sets of tools, eight speed lathes, sixteen engine lathes, Fox monitor turret lathe, two planers, two shapers, two milling machines, two upright drills, sensitive drill, grinding machines, tool grinders, emery wheels, etc. The tool-room contains full sets of drills, taps, dies, milling cutters, standard plugs, gauges, threads, micrometers and a great variety of special tools.

1. Tools and Machines. Principles underlying the construction and operation of machine tools, and materials used in construction. Three credit hours. Courses in Industrial Arts and Manual Training, third year; Short Course in Industrial Arts, second year, first, second and third terms, Tu., Th., S., 8. Prerequisite, Mathematics 14 or 32, Concurrent, Physics 1.

2. Designing. Problems in design, to accompany 1. Three credit hours. Courses in Industrial Arts and Manual Training, third year; Short Course in Industrial Arts, second year, second and third terms, F., 1-4, S., 9-12.

3. Shop Equipment, Appliances and Management. Strength and durability of the materials used in construction; shop and factory buildings and their construction; power, power transmission and prime movers; methods of compensation and shop accounts and management. Three credit hours. Course in Industrial Arts, fourth year, first, second and third terms, M., W., F., 11. Prerequisite, Industrial Arts 1, Concurrent, Industrial Arts 4.

4. Advanced Designing. Graphical problems in construction. Design of buildings and the arrangement of machinery, line-shafting, etc., for manufacturing plants. Three credit hours. Course in Industrial Arts, fourth year, first and second terms, M., Tu., 1-4; third term, W., Th., 1-4. Prerequisite, Drawing 5. Concurrent, Industrial Arts 3.



HAYES HALL.

THE
JOHN CRERAR
LIBRARY

5. Workshop Appliances. Lectures and problems on the construction of shop buildings and the arrangement of machinery; special shop appliances. Three credit hours. Course in Mechanical Engineering, fourth year, third term, M., W., F., 8. Prerequisite, Civil Engineering 19.

8. Machine Drawing. Working sketches of mechanisms and machines from measurement; detail and assembly drawings of same. Three credit hours. Short Course in Industrial Arts, second year, first term, W., Th., 1-4. Prerequisite, Drawing 39.

9. Machine Design. Practical application of the principles of machine design. Two credit hours. Course in Electrical Engineering, fourth year, second term, M., W., 1-3. Prerequisite, Mathematics 72 and Drawing 5.

Mathematics

Office, University Mall, Room 45.

PROFESSOR BOHANNAN, ASSOCIATE PROFESSOR MCCOARD, ASSOCIATE PROFESSOR BOYD, ASSISTANT PROFESSOR ARNOLD, ASSISTANT PROFESSOR SWARTZEL, ASSISTANT PROFESSOR KUHN, ASSISTANT PROFESSOR CODDINGTON, MR. RASOR.

2. Elementary Algebra. Five credit hours. Short Courses in Clay Working, Industrial Arts and Mining, first year, first, second, third terms, M., Tu., W., Th., F., 9.

3. Plane Geometry. Five credit hours. Short Courses in Clay Working, Industrial Arts and Mining, first year, first term, M., Tu., W., Th., F., 11.

11. Differential Equations. One credit hour. Course in Mechanical Engineering, third year, first term, F., 10. Prerequisite, Mathematics 43.

13. Solid Geometry. Five credit hours. Short Courses in Clay Working, Industrial Arts and Mining, first year, second term, M., Tu., W., Th., F., 11. Prerequisite, Mathematics 3.

14. Trigonometry. Plane trigonometry. Five credit hours. Short Courses in Clay Working, Industrial Arts and Mining, first year, third term, M., Tu., W., Th., F., 8. Prerequisite, Mathematics 2.

31. College Algebra. Five credit hours. All four-year courses, first year, first term, M., Tu., W., Th., F., 8, 9, 11, 1 or 2. Prerequisite, Mathematics 2.

32. Trigonometry. Five credit hours. All four-year courses, first year, second term, M., Tu., W., Th., F., 8, 9, 11, 1 or 2. Prerequisite, Mathematics 2.

33. Analytic. Five credit hours. All four-year courses, first year, third term, M., Tu., W., Th., F., 8, 9, 11, 1 or 2. Prerequisite, Mathematics 32.

41. Calculus. Five credit hours. Second year, first term.
M., Tu., W., Th., F., 1 — Course in Architecture.
" 8 — Course in Ceramics.
" 8 — Course in Chemical Engineering.
" 11 or 1 — Course in Civil Engineering.
" 8 — Course in Electrical Engineering.
" 8 — Course in Mechanical Engineering.
" 8 — Course in Mining Engineering.
Prerequisite, Mathematics 33.

42. Calculus. Five credit hours. Second year, second term. For hours and courses see Course 41. Prerequisite, Mathematics 41.

43. Calculus. Five credit hours. Second year, third term. For hours and courses see Course 41. Prerequisite, Mathematics 41.

71. Mechanics. Statics. Five credit hours. Courses in Architecture, Ceramics, and Chemical, Civil, Electrical, Mechanical and Mining Engineering, third year, first term, M., Tu., W., Th., F., 8, 9 or 11. Prerequisite, Mathematics 43.

72. Mechanics. Strength of Materials. Kinetics. Five credit hours. Courses in Architecture, Ceramics, and Chemical, Civil, Electrical, Mechanical and Mining Engineering, third year, second term, M., Tu., W., Th., F., 8, 9, 11, or 2. Prerequisite, Mathematics 71.

73. Mechanics. Kinetics. Hydraulics. Five credit hours. Courses in Ceramics, and Chemical, Civil, Electrical, Mechanical and Mining Engineering, third year, third term, M., Tu., W., Th., F., 8, 9 or 11. Prerequisite, Mathematics 72.

74. Differential Equations. Three credit hours, second term. Elective. Prerequisite, Mathematics 43.

EXPERIMENTAL ENGINEERING LABORATORY.

Mechanical Engineering

Office, Hayes Hall, Room 11.

Professor Magruder, Professor Hitchcock, Assistant Professor Judd, Assistant Professor King, Mr. Hopkins, Mr. Rigdon.

The lectures and recitations of this Department are held in Hayes Hall, and the laboratory work in Mechanical Hall. The technical museum in Hayes Hall contains samples of engineering supplies and materials and a collection of models of mechanism and valve gears.

The laboratories are arranged to carry on experiments and investigations along the following general lines: Strength of materials in compression, tension, torsion and cross breaking; gas, hot air, and steam engines, under varied conditions of running; hydraulics, including pumps and water-wheels; pneumatics, including air-brakes, compressors, fans and ventilating systems; power transmission, including belts, pulleys and oils; boiler testing; calibration of instruments.

Some of the principal machines for the above work are Olsen and Riehlé testing machines; four gas and oil engines; Ericsson and Rider hot-air engines; three 35-horse power horizontal and one vertical simple and compound steam engines with condensers; simple, compound, triplex, centrifugal and rotary pumps, pulsometer, turbine and impulse wheels, tanks, wiers, meters, hydraulic engines and rams; set of Westinghouse air-brake apparatus, air-compressors, compressed air engine, blower and ventilating fans; belt machines, lubricant and oil testers; Robinson experiment steam boiler, with natural, forced and induced drafts, air-preheater, and economizer; calorimeters, injectors, gauges. The University power and refrigerating plants and the mechanical equipments in the different buildings upon the grounds add to the facilities for engineering tests.

Besides the above, opportunities frequently arise for the students to take part in tests made of machinery, engines and boilers in the city and vicinity.

3. Mechanism. Lectures and recitations on the principles of mechanism and mechanical movements. Five credit hours. Course in Mechanical Engineering, third year, second term, M., Tu., W., Th., F., 8 or 9. Prerequisite, Drawing 33 and Physics 2. The accurate laying out of movements, embodying the principles of mechanism. Two credit hours. Course in Mechanical Engineering, third year, third term, M., Tu., 1-3. Professor Hitchcock.

12. Experimental Engineering Laboratory. Calibration of pressure gauges and indicator springs; steam engine indicator practice and oil testing. Two credit hours. Course in Mechanical Engineering, third year, first term, W., 1-5, S., 8-12. Course in Industrial Arts, fourth year, first term, Th., 1-5. Prerequisite, Drawing 33. Concurrent, Mathematics 71, or Industrial Arts 3. ASSISTANT PROFESSORS JUDD AND KING, MR. RIGDON.

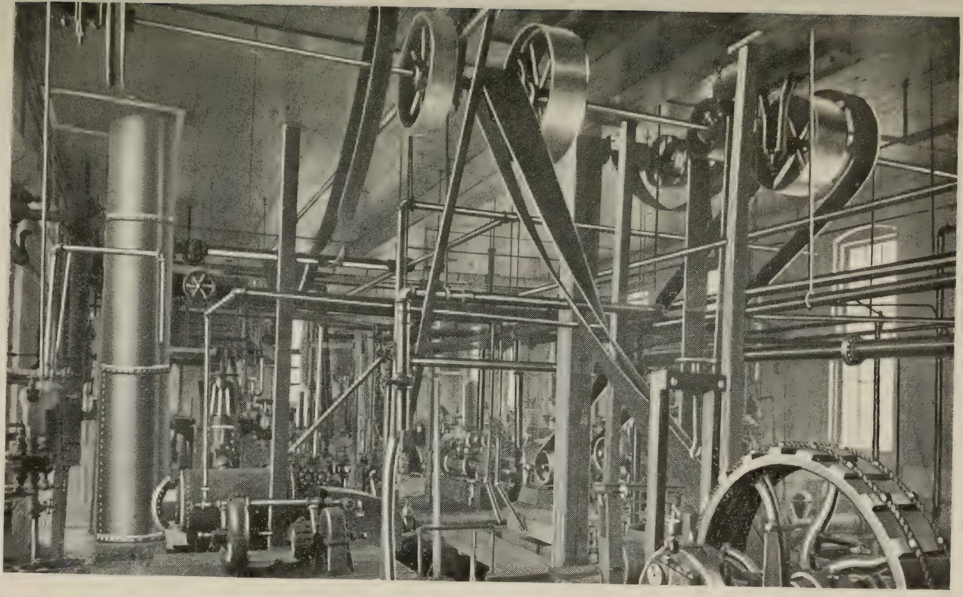
14. Continuation of 27, including testing of steam boilers and injectors. Four credit hours. Course in Mechanical Engineering, fourth year, second term, M., W., 1-5. Concurrent, Mechanical Engineering 34. PROFESSOR HITCHCOCK, ASSISTANT PROFESSORS JUDD AND KING.

15. Continuation of 14, including testing of steam, centrifugal and power pumps, pulsometer, hydraulic rams, impulse and turbine water-wheels, and air compressors. Three credit hours. Course in Mechanical Engineering, fourth year, third term, M., Tu., 9-12. PROFESSOR HITCHCOCK, ASSISTANT PROFESSORS JUDD AND KING.

17. Experimental Engineering. Practice in the testing of materials of construction, calibration of orifices and weirs, study of the flow of liquids and gases, accompanied by lectures and recitations on laboratory practice, steam engines, boilers and power transmission. Three credit hours. Course in Civil Engineering, fourth year, second term, Th., 11, F., 1-5. Prerequisite, Drawing 33 and Mathematics 73. PROFESSOR HITCHCOCK, ASSISTANT PROFESSORS JUDD AND KING.

18. Machine Design. Recitations on Unwin's Machine Design, with lectures on American practice. Five credit hours. Course in Chemical Engineering, fourth year, first term, M., Tu., W., Th., F., 11. Course in Mechanical Engineering, fourth year, first term, M., Tu., W., Th., F., 9. Courses in Chemical and Mechanical Engineering, fourth year, second term, M., Tu., W., Th., F., 11. Prerequisite, Drawing 5 or 33; Mathematics 73. PROFESSOR MAGRUDER.

19. Machine Design. Practical applications of the principles of machine design. Five credit hours. Courses in Chemical and Mechanical Engineering, fourth year, third term, M., 1-5, Tu., W., 1-4. Prerequisite, Mechanical Engineering 18. PROFESSOR MAGRUDER.



MECHANICAL LABORATORY.

21. Thesis Work. Five credit hours. Course in Mechanical Engineering, fourth year, third term. PROFESSORS MAGRUDER AND HITCHCOCK.

23. Materials of Construction. Lectures and recitations on the materials used in architectural and building construction, and laboratory exercises on their properties. Four credit hours. Courses in Architecture, fourth year, first term, Tu., Th., 8, W., 1-5. Prerequisite, Mathematics 71. PROFESSOR HITCHCOCK.

24. Experimental Engineering Laboratory. Arranged to meet the needs of those desiring to elect advanced laboratory work. Three credit hours. First and second terms. Elective to third and fourth year engineers. (Not given in 1905-6.)

25. Continuation of 17, including tests of steam, power, rotary and centrifugal pumps; water motor and turbine wheel. Five credit hours. Course in Civil Engineering, fourth year, third term, Th., 11, M., Tu., 1-5. PROFESSOR HITCHCOCK, ASSISTANT PROFESSORS JUDD AND KING.

27. Continuation of 12, including testing materials of construction, tests of steam and hot air engines, transmission and absorption dynamometer trials and testing of belts. Five credit hours. Course in Mechanical Engineering, fourth year, first term, M., 1-5, F., 10-5. Concurrent, Mechanical Engineering 33. PROFESSOR HITCHCOCK, ASSISTANT PROFESSORS JUDD AND KING.

28. Experimental Engineering Laboratory. Testing of pressure gauges and indicator springs, steam engine indicator practice and testing of lubricating oils. Two credit hours. Course in Electrical Engineering, third year, third term, Th. or F., 1-5. Course in Manual Training, fourth year, third term, F., 1-5. Concurrent, Mechanical Engineering 32. ASSISTANT Professors JUDD AND KING, AND MR. RIGDON.

29. Continuation of 28, including testing materials of construction, transmission and absorption dynamometer tests, steam engine trials. Three credit hours. Course in Electrical Engineering, fourth year, first term, Tu., or Th., 10-12, 1-5. Two credit hours. Course in Industrial Arts, fourth year, second term, W., 1-5. ASSISTANT PROFESSORS JUDD and KING and MR. RIGDON.

30. Continuation of 29, including steam engine and boiler trials, steam and power pump tests and hydraulic experimentation, gas and oil engine trials. Two credit hours. Course in Electrical Engineering, fourth year, second term, Tu., or Th., 1-5. Course in Industrial Arts, fourth year, third term, F., 1-5. ASSISTANT PROFESSORS JUDD AND MR. RIGDON.

31. Hydraulic Machinery. Recitations and lectures on pumping machinery. Three times a week. Course in Mechanical Engineering, fourth year, third term, Tu., Th., 8, W., 9. Prerequisite, Mathematics 73 and Mechanical Engineering 33. PROFESSOR HITCHCOCK.

32. Mechanical Engineering of Power Plants. A descriptive study of steam and gas engines, boilers, pumps, injectors and other machinery used in plants generating power. Five credit hours. Courses in Chemical and Electrical Engineering, and Industrial Arts, third year, third term, M., Tu., W., Th., F., 9. Course in Mechanical Engineering, third year, third term, M., Tu., W., Th., F., 8. Course in Manual Training, fourth year, third term, M., Tu., W., Th., F., 8. Prerequisite, Mechanical Engineering 3, or Industrial Arts 1; Drawing 5 or 22; and Physics 2. PROFESSOR MAGRUDER.

33. Steam Engines and Boilers. A detail study of steam using and steam generating machinery. Five credit hours. Courses in Electrical and Mechanical Engineering, fourth year, first term, M., Tu., W., Th., F., 8. Prerequisite, Mathematics 73 and Mechanical Engineering 32. PROFESSOR MAGRUDER.

34. Thermodynamics. The transmutations of heat and mechanical energies in steam, gas and air engines, and in air and ammonia compressors, together with a study of the tests of ideal and actual engines and of their indicator diagrams; the flow of gases through pipes and orifices. Five credit hours. Course in Mechanical Engineering, fourth year, second term, M., Tu., W., Th., F., 8. Prerequisite, Mechanical Engineering 33. PROFESSOR MAGRUDER.

35. Experimental Engineering Laboratory. Five credit hours. Option, Course in Chemical Engineering, fourth year, second term, M., 9, M., Tu., 1-5. Prerequisite, Mathematics 73 and Mechanical Engineering 32.

36. Experimental Engineering Laboratory. Lectures and recitations on power transmission, steam engines and boilers. Laboratory; testing pressure gauges, indicator springs, etc.; valve setting; testing of steam engines, steam, power and centrifugal pumps; boiler and fuel trials. Five credit hours. Courses in Ceramics and Mine Engineering, fourth year, third term, Tu., Th., 10-11, W., Th., 1-4. Prerequisite, Mathematics 73 and Metallurgy 4. PROFESSOR HITCHCOCK, ASSSISTANT PROFESSORS JUDD and KING.

37. Mechanism. Lecture and recitations on the principles of mechanism and mechanical movements. Four credit hours. Courses in Ceramics and Electrical Engineering, third year, second term, M., Tu., Th., F., 10. PROFESSOR HITCHCOCK.

38. Inspection Trip to the East, including Pittsburg, Buffalo, Niagara Falls, Cleveland, and possibly other places, taken at the end of the Winter term, occupies six days and is open to third and fourth year students. The entire expense need not exceed $30.00. A satisfactory written report upon the work of the trip is required. Given only in the even years. Required in the Course in Mechanical Engineering, third or fourth year.

39. Inspection Trip to the West, including Chicago, Milwaukee, Cincinnati, and possibly other places, taken at the end of the Winter term, occupies six days, and is open to third and fourth year students. The entire expense need not exceed $30.00. A satisfactory written report upon the work of the trip is required. Given only in the odd years. Required in the Course in Mechanical Engineering, fourth or third year.

40. A satisfactory written report on a course of assigned reading upon processes of manufacture and power plants may be taken by third and fourth year students in the Course in Mechanical Engineering as a substitute for 38 on presentation of satisfactory reasons to the head of the department.

41. Similar to 40. As a substitute for 39.

Metallurgy

(DEPARTMENT OF METALLURGY AND MINERALOGY.)

Temporary Office, Townshend Hall, Second Floor.

PROFESSOR N. W. LORD, ASSISTANT PROFESSOR SOMERMEIER, MR. DEMOREST.

On account of the destruction by fire of the Chemical Building at the State University, the Department of Metallurgy and Mineralogy is occupying temporary quarters in Townshend Hall, the work being carried on in the laboratories of the Department of Agricultural Chemistry. The Legislature has provided the funds for the construction of a special building to be occupied by the Departments of Metallurgy, Mining Engineering and Ceramics. This building is now in process of construction and it is hoped will be ready for occupancy during the coming year. It will be provided with complete laboratories and equipment for assaying, metallurgical analysis, general and determinative mineralogy, technical gas analysis, coal sampling and testing, including determinations for heating value, microscopic metallographic work and crushing and sampling machinery for use in experimental tests on ores and minerals.

2. Mineralogy. Lectures arranged so as to be preparatory to Determinative Mineralogy (Course 3). Three credit hours. Courses in Chemical and Mining Engineering, second year, third term, M., W., F., 11. Prerequisite, Chemistry 12.
3. Determinative Mineralogy. Laboratory course in practical determination of minerals by physical and chemical tests. Each student is furnished with a set of apparatus, and works under an instructor's inspection. Brush's Determinative Mineralogy is used as a manual. Five credit hours. Course in Mining Engineering, third year, third term, M., Tu.,1-5. Prerequisite, Metallurgy 2.
4. Metallurgy. A course of lectures upon fuel and its uses, iron and steel, copper, lead, gold and silver, their properties, tests, ores and details of the methods of reduction. The lectures are supplemented by a careful study of references to standard works and journals. Five credit hours. Course in Mining Engineering, third year; Option, Course in Chemical Engineering, fourth year, first and second terms, M., Tu., W., Th., F., 9. Courses in Industrial Arts and Mechanical Engineering, third year; Course in Ceramics, fourth year, first term, M., Tu., W., Th., F., 9. Two credit hours. Courses in Industrial Arts and Mechanical Engineering, third year, first two-fifths of the second term, M., Tu., W., Th., F., 9. Prerequisite, Chemistry 12 and Physics 2.

MILITARY DRILL.

5. Metallurgical Laboratory. Lectures and laboratory work. Laboratory practice in the analysis of iron and steel, fuel and slags, and the assay of lead, copper and zinc ores by wet methods, using approved methods as practiced in technical laboratories of metallurgical works. Five credit hours. Course in Mining Engineering, second year, first, second and third terms; Course in Chemical Engineering, third year, first term, W., Th., F., 1-4. Prerequisite, Chemistry 12.

6. Assaying. Laboratory work. Practical work in the assaying of gold, silver and lead ores, by furnace methods. Five credit hours. Courses in Chemical and Mining Engineering, third year, second term, M., Tu., 11, 1-5. Prerequisite, Metallurgy 5, one term.

7. Metallurgical Construction. Practice in the designing of furnaces and other metallurgical machinery, including detail drawings and estimates. Three credit hours. Course in Mining Engineering, fourth year, second term, Th., F., 1-4. Prerequisite, Drawing 5, Mathematics 73, Metallurgy 6 and 8.

8. Ore Dressing and Coal Washing. Methods of concentrating and enriching ores and fuels by mechanical means. Lectures, with reference to standard books and various papers in technical journals. Two credit hours. Course in Mining Engineering, fourth year, first term, Tu., F., 10. Prerequisite, Metallurgy 4.

9. Mineral Chemistry. Lectures upon fire-damp, mine explosions, explosives, boiler waters, poisonous gases, iron ores; iron and steel, their properties and modes of manufacture; coal and coke. Five credit hours. Short Course in Mining, second year, third term, M., Tu., W., Th., F., 8. Prerequisite, Chemistry 3.

Military Drill

Office, Armory Room.

CAPTAIN GEORGE L. CONVERSE, U. S. A., RETIRED.

The same building used as a gymnasium is also employed as Armory and Drill Hall. The University Battalion is in charge of a Commandant from the United States Army, apart from whom it is officered entirely by students. Besides its military importance, as shown by the prominent place taken by former students in the Ohio troops of the late war and in the United States Army, military drill has great value in the physical development of the student.

The Fall work is carried on outdoors, weather permitting, and is largely devoted to squad drill in the setting up exercises, facings, marching, etc., and company drill according to progress of the squads. During the Winter months drill is confined to work inside the Gymnasium, manual of arms, guard mounting and such ceremonies as can be performed within a limited space. After April 1st all work is again outside, weather permitting, as follows: Mondays, company drill; Tuesdays, battalion drill; Wednesdays, ceremonies other than guard mounting; Thursdays, guard mounting and company drill. During the entire year at the same hours as the drill the O. S. U. Band either has its practice hour or takes part in ceremonies and drill. Similarly the Signal Corps belonging to the battalion exercises in the flag drill or at telegraph work. Army regulations are followed strictly. The military department is open five days per week of each term.

1. Military Drill. Four times a week, from the opening of College until the Thanksgiving vacation; twice a week from Thanksgiving until April first; four times a week until the close of the school year. Required of all able-bodied male students during first and second years of their course.

2. Tactics. Lectures and recitations. Twice a week. Second term. Elective.

4. Customs of the Service. Lectures and recitations. Twice a week. Second term. Required of the whole battalion.

Mine Engineering

Temporary Office, Brown Hall, Room 21.

Professor Ray, Mr. Simon, Mr. ———

This Department is equipped with all of the latest improved instruments and apparatus used in mine engineering, surveying and the study of mine ventilation. There is a collection of models of mine machinery and supplies, to which additions are being made; also a large collection of lantern views of machines, mines and mine equipment. In the draughting room each student is personally taught the making of maps, the platting of actual surface and underground surveys, the making of drawings, tracings and blue-prints.

Emphasis is laid upon proper methods of keeping notes and all records necessary to an efficient engineer's office. The students make actual surveys of coal mines and work up their notes complete in all of the necessary details. They are also taught how to make working drawings, plans, estimates and specifications of mining operations and equipment.

The Mining Engineering Course pays special attention to underground surveying, mapping, timbering, ventilation and other matters relating to safety and speed, system and method in extracting coal and other minerals. The coal mines of central Ohio furnish extremely valuable illustrations of the practice in these lines and of the general arrangement of mining plants. The mining students are required to make frequent trips and to spend sufficient time at the mines in actual work and observation to become familiar with practical mine surveying and the details of mine equipment and management.

1. Mine Surveying. Lectures and field practice. This is similar to Course 4, but more elementary. The same text is used. The students have more practice in the drawing room. Five credit hours. Short Course in Mining, second year, first term, M., Tu., W., Th., F., 11. Prerequisite, Mathematics 14.

2. Ventilation and Haulage. Lectures illustrated by experiments and maps of mines and models when possible, tests by safety lamps and anemometers, and methods of air distribution in coal mines. Five credit hours. Short Course in Mining, second year, second term, M., Tu., W., Th., F., 11. Prerequisite, Mine Engineering 1 and Physics 1.

3. Mine Operating. A course of lectures and practical instruction in mine book-keeping and accounts, cost of working, etc., particularly adapted to Ohio coal mining. Five credit hours. Short Course in Mining, second year, third term, Tu., Th., F., 10, M., 9-11. Prerequisite, Mine Engineering 2.

4. Mine Surveying. Field practice in the use of instruments for surface and underground surveys. Full notes are taken and maps and plans made in the drawing room. Davies's Surveying by Van Amringe is used as a text-book. Five credit hours. Courses in Mining Engineering and Ceramics, third year, first term, M., Tu., Th., F., 10, M., 1-3. Prerequisite, Drawing 33 and Mathematics 32.

5. Mine Engineering. Lectures. Mine operating, mining machinery, ventilation, shaft-sinking, working out deposits, etc. Constant reference is required to the standard works and to the leading technical journals, with practice in designing mine plants, draughting and estimates. Five credit hours. Course in Mining Engineering, fourth year, first, second and third terms, M., Tu., W., Th., F., 8. Prerequisite, Mathematics 73 and Mine Engineering 4. Concurrent, Geology 2.
6. Plans and Specifications. Five credit hours. Course in Mining Engineering, fourth year, third term, M., F., 10, M., Tu., 1-4. Prerequisite, Metallurgy 7 and Mine Engineering 5.
7. Surveying. Practical experience in surveying in some mine convenient to Columbus; the time taken in one trip of not more than four consecutive days. One credit hour. Course in Mining Engineering, third year; Short Course in Mining, second year; second term. Prerequisite, Mine Engineering 1 or 4.

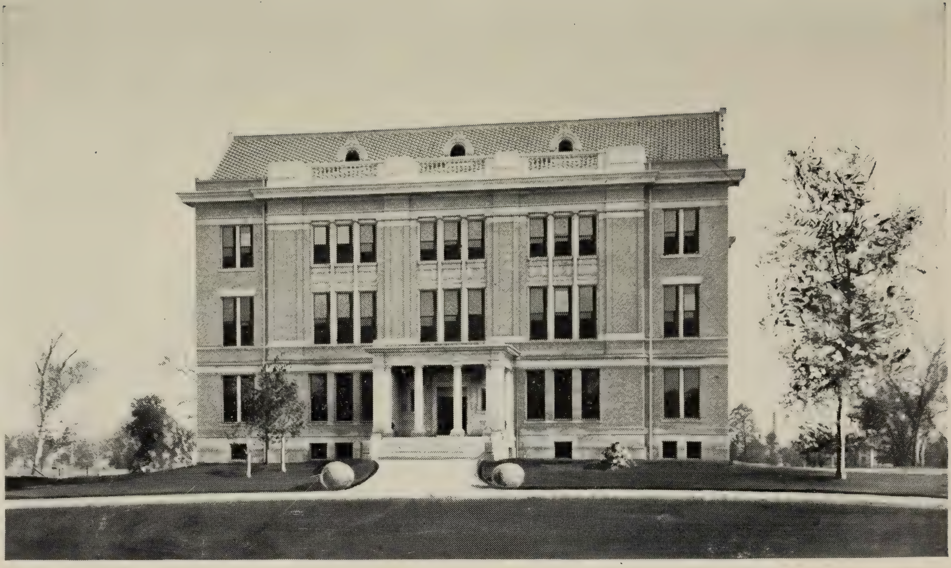
Physics

Office, Physics Building, First Floor.

PROFESSOR THOMAS, PROFESSOR COLE, ASSISTANT PROFESSOR KESTER, ASSISTANT PROFESSOR EARHART, MR. AYRES, MR. ———

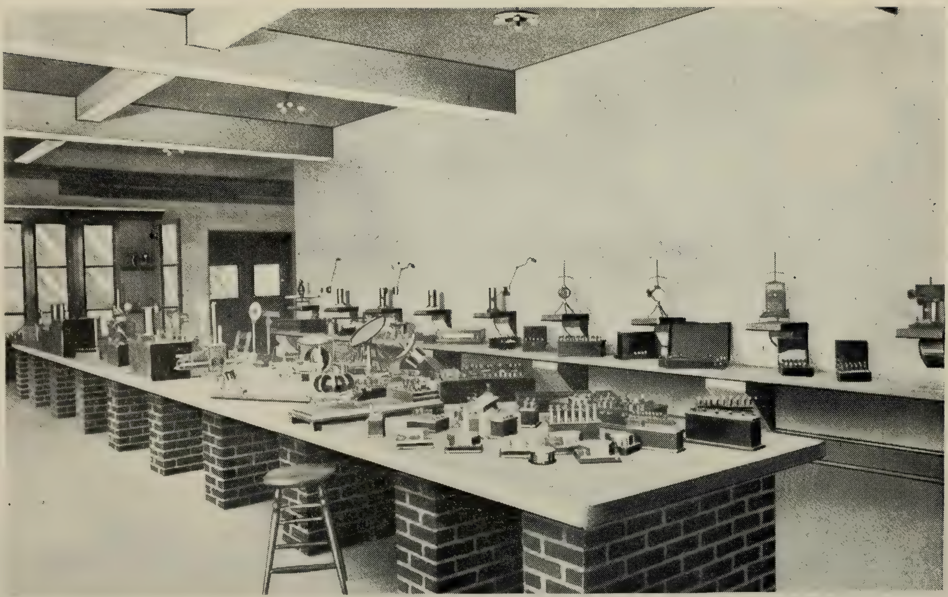
The Department of Physics occupies the three stories and basement of the new Physics Building, a building in the design and construction of which special care has been taken to secure ample light, ventilation, and rigidity of floors and supports. The floor area of the building is thirty thousand square feet. The two wings included in the plan of the building will, when erected, add twenty-five thousand square feet of floor area. The Department has a generous supply of apparatus, for the experimental illustration of the lecture courses, and for elementary and advanced laboratory work. The best instrument makers of this and foreign countries are well represented in the equipment, which is especially strong in standards, and in apparatus for precise measurement.

1. Elementary Physics. Recitations, experimental lectures and laboratory. Text: Carhart & Chutes' "Elements of Physics." Five credit hours. Short Course in Mining, first year, first and second terms, M., Tu., W., Th., 8, and one three-hour laboratory period, any afternoon, 1 to 4, or Saturday morning. Short Courses in Clay-working and Industrial Arts, second year, first and second terms, M., Tu., W., Th., 11, and one laboratory period, as above. Prerequisite, Mathematics 14. DR. EARHART.



PHYSICS BUILDING.

THE
JOHN CRERAR
LIBRARY



ELECTRICAL MEASUREMENTS LABORATORY—PHYSICS BUILDING.

2. Mechanics and Heat. Electricity and Magnetism. Sound and Light. Lectures and recitations. Three credit hours. All four-year courses, second year, first, second and third terms, M., W., F., 9. Prerequisite, Mathematics 33. PROFESSOR THOMAS.

3. Physics. Extension of Course 2, with practice in solution of problems. Two credit hours. Courses in Electrical Engineering, Ceramics, Industrial Arts and Manual Training, second year, first, second and third terms, Tu., Th., 9. Concurrent, Physics 2.

4. Electricity and Magnetism. Lectures and recitations. Three credit hours. Course in Electrical Engineering, third year, first term, M., Tu., Th., 10. Prerequisite, Mathematics 43 and Physics 2 and 3. PROFESSOR THOMAS.

5. Physical Laboratory. Elementary manipulation. Length, mass and time measurements. Work in density, elasticity and in heat. Four credit hours. Course in Electrical Engineering, second year, third term, M., Tu., 1-4, W., 1-3; or Th., F., 1-4, S., 8-10. Option, Course in Manual Training, third year, first, second and third terms, M., Tu., 1-4, W., 1-3. Prerequisite, Physics 2.

6. Physical Laboratory. Theory and practice of magnetic and and electrical measurement, including the testing and standardizing of instruments; conductivity of conductors; insulation, capacity and resistance of insulated conductors and cables; temperature co-efficients; commercial measuring and testing instruments; strength and distribution of magnetic fields; magnetic moments, permeability; work in light, including optical constants; spectroscopy; photometry of gas, electric and other lights. Five credit hours. Course in Electrical Engineering, third year, first and second terms, M., Tu., W., 1-4. Prerequisite, Physics 5. Concurrent, Physics 4.

7. Physical Laboratory. Two credit hours. Course in Mechanical Engineering, second year, second term, M., Tu., 1-3; or Th., F., 1-3. Three credit hours. Course in Mechanical Engineering, second year, third term, M., Tu., 1-4; or Th., F., 1-4. Three to five credit hours. First, second and third terms. Elective. Concurrent, Physics 2.

9. Physical Laboratory. A second year's work in Physical Laboratory. Three to five credit hours. Elective. Prerequisite, Physics 6 or 7.

Political Science

(DEPARTMENT OF AMERICAN HISTORY AND POLITICAL SCIENCE.)

Office, University Hall, Room 15.
PROFESSOR KNIGHT, MR. SPENCER.

1. Political Institutions of the United States. Lectures and recitations. A study of the origin and nature of the political institutions of the United States, and an analysis of the form and powers of the government. Bryce's American Commonwealth; Burgess's Political Science. Three credit hours. Course in Manual Training, fourth year, first term, M., W., F., 8. Prerequisite, American History 1.

Shopwork

(DEPARTMENT OF INDUSTRIAL ARTS.)

Office, Hayes Hall, Room 2.

PROFESSOR SANBORN, ASSISTANT PROFESSOR KNIGHT, MR. RENCK, MR. CROWE.

Note.—For time requirements, credit given, and all similar information concerning shopwork courses, see table page 94.

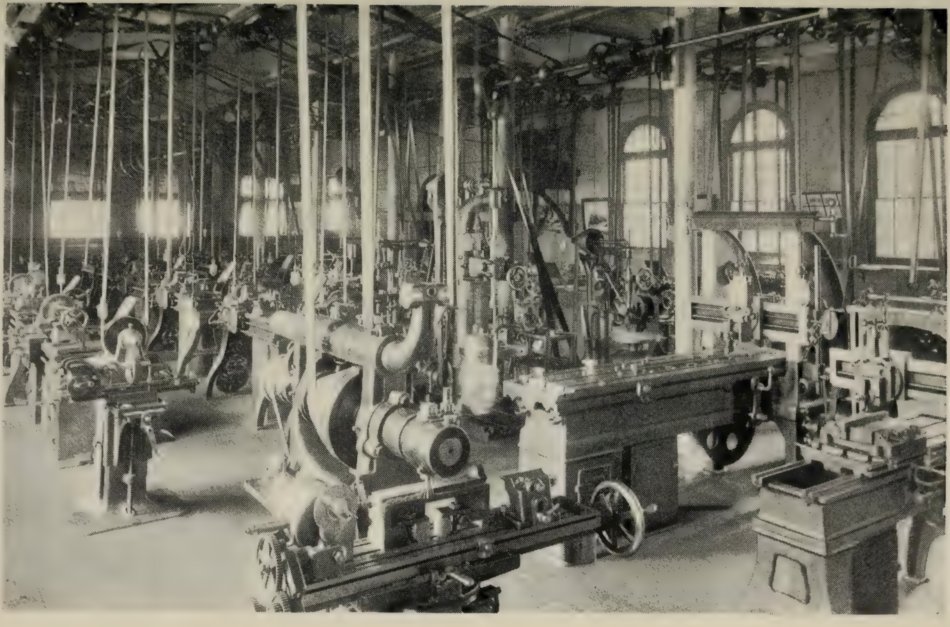
3. Foundry Work. Exercises and practice in tempering sand and preparing moulds of machine parts in the sand, core-making, melting iron and brass and pouring castings. MR. RENCK.

4. Chipping and Filing. Exercises and practice in vise work, including chipping in cast and wrought iron, surface filing, squaring, fitting, finishing, and the scraping of surface plates. ASSISTANT PROFESSOR KNIGHT.

7. Carpentry and Pattern Making. Exercises and practice in carpentry, wood-turning and pattern-making, including sawing, planing, mortising, splicing, framing and other work involving the use of the ordinary carpenter tools; center and chuck turning; the making of finished patterns; and enough elementary molding to illustrate draft, parting, cores, etc. MR. RENCK.

8. Carpentry Cabinet Work. Exercise and practice in cabinet making, including panelling, mitre and dovetail joints, etc.; use of power tools. Prerequisite, Shop 7. MR. RENCK.

9. Advanced Pattern Making. Continuation of pattern work of Shopwork 7. MR. RENCK.



MACHINE SHOP.

THE
JOHN CRERAR
LIBRARY

11. Forging. The use and care of forge, fire and tools; practice in iron and steel forging, including such operations as cutting, bending, drawing, upsetting, shaping and welding iron; the making, hardening and tempering of steel punches, chisel and lathe tools. MR. CROWE.

12. Advanced Forging. Various forms of welds in iron and steel; the use of scrolling irons and of forms for duplicating work; annealing; tool making; case-hardening; tempering drills, dies and cutters; spring making; ornamental iron work; visits to shops. Prerequisite, Shop 11. MR. CROWE.

13. Machine Work. Exercises and practice in hand-turning in iron and brass on speed lathes; in straight and taper turning, boring, fitting, chucking, and thread-cutting on engine lathes. ASSISTANT PROFESSOR KNIGHT.

14. Machine Work. Exercises and practice on the lathe, planer, shaper, drill press and milling machine, with use of small tools as drills, taps, dies, reamers, counterborers, etc.; construction of parts of actual machines. Prerequisite, Shop 13. ASSISTANT PROFESSOR KNIGHT.

15. Advanced Machine Work. Exercises and practice on turret lathe, universal, surface and tool grinding machines; in gear-cutting, etc. Prerequisite, Shop 14. ASSISTANT PROFESSOR KNIGHT.

16. Advanced Machine Work. The construction and use of jigs and templates; the accurate laying out of work; the duplication of parts, the production of work rapidly and economically, etc. Prerequisite, Shop 15. ASSISTANT PROFESSOR KNIGHT.

17. Advanced Machine Work. The making and use of special tools and fixtures, standard plugs and collars, standard caliper and limit gauges; error limits in modern machine construction; methods of testing the accuracy of machine tools, etc. Prerequisites, Shop 16. ASSISTANT PROFESSOR KNIGHT.

Summer Term. The Summer Term in Shopwork will begin on Monday morning preceding Commencement Day and continue for four weeks. The courses open to students are Shopwork (4) (7) (11) (13) (14) and (15), three credit hours in each.

Each course requires three hours a day for six days a week. Students electing the Ceramics or Electrical or Mechanical Engineering Course are required to take two of the three courses, Shopwork (4) (7) and (11) at the close of their first year.

Students electing the Chemical Engineering Course are required to take Shopwork courses (7) and (11) at the close of their first or second year.

Students in the Short Course in Clay-working are required to take Shopwork (7) and (11) at the close of their first year.

The courses are open as elective to students who desire to lighten their work of the regular terms, to make up back work or to take extra work.

Shopwork Required

Number	Credit hours	Subject	Year	Term	Hours	Courses in
3	2	Founding	2	1	M. 3, Tu. 1-4; W. 3, Th. 1-4; or S. 8-12	Mech. Eng.
3	2	Founding	2	1	M. 3, Tu. 1-4	Short Ind. Arts
3	3	Founding	2	1	M. 1-4; Tu. 1-4	Ind. Arts; Man. Tr.
3	2	Founding	..	2	M. 3, Tu. 1-4	....
4	3	Chipping and Filing	2	1	F. 1-4; S. 9-12	Short Ind. Arts
4	3	Chipping and Filing	..	......	(See Courses)	El. Eng.; Mech. Eng.
4	3	Chipping and Filing	3	1	M. Tu. 1-4	Ind. Arts.
4	3	Chipping and Filing	3	1	M. Tu. 9-12	Manual Train.
4	3	Chipping and Filing	..	1, 2, 3	M. Tu. 9-12; Th. F. 9-12; M. Tu. 1-4: W. Th. 1-4; or F. 1-4, S., 8-11	....
7	2	Woodworking	2	1	M. F. 10-12	Mining Eng.
7	3	Woodworking	1	1	M. Tu. 1-4	Short Ind. Arts.
7	3	Woodworking	2	1	F. 1-4, S. 8-11	Manual Train.
7	3	Woodworking	2	1	Th. F. 1-4	Ind. Arts.
7	3	Woodworking	..	......	(See Courses)	Chem., El. & Mec. E.
7	3	Woodworking	..	2, 3	M. Tu. 9-12; Th. F. 9-12; Th. F. 1-4; or W. 1-4, S. 8-11	....
8	3	Cabinet Work	2	3	M. Tu. 1-4	Ind. Arts; Man. Tr.
9	3	Adv. Pattern Work.	..	1	Tu. Th. 9-12; or W. Th. 1-4	....
9	3	Adv. Pattern Work.	1	2	M. Tu. 1-4	Short Ind. Arts.
9	3	Adv. Pattern Work.	2	2	M. Tu. 1-4	Ind. Arts; Man. Tr.
9	3	Adv. Pattern Work.	..	......	(See Course)	Mech. Eng.
11	3	Forging	..	1	M. Tu. 9-12; Th. F. 9-12; M. Tu. 1-4; W. Th. 1-4; or F. 1-4, S, 8-11	....
11	3	Forging	..	2	M. Tu. 9-12; M. Tu. 1-4; Th. F. 1-4; or W. 1-4, S. 8-11	....

Shopwork Required — Continued

Number	Credit hours	Subject	Year	Term	Hours	Courses in
11	3	Forging	..	......	(See Courses)	Chem. El. & Mec. E.
11	2	Forging	2	2	Th. F. 10-12	Mining Eng.
11	3	Forging	2	2	Th. F. 1-4	Ind. Arts; Man. Tr.
11	3	Forging	1	3	M. Tu. 1-4	Short Ind. Arts.
11	3	Forging	1	3	M. Tu. 1-4	Short Mining
11	3	Forging	..	3	M. Tu. 9-12; or Th. F, 9-12	....
12	3	Adv. Forging	2	3	F. 1-4; S. 8-11	Ind. Arts; Man. Tr.
13	3	Machine Work	2	2	M. Tu. 1-4; or W. Th. 1-4; or F. 1-4, S, 8-11.	Elec. Eng.
13	3	Machine Work	3	2	M. Tu. 1-4	Manual Train.
13	3	Machine Work	3	2	M. Tu. Th. 10-12	Ind. Arts.
13	3	Machine Work	2	2	W. Th. 1-4	Short Ind. Arts.
13	3	Machine Work	2	3	M. Tu. 1-4; or F. 1-4, S. 8-11	Mech. Eng.
14	3	Adv. Machine Work	3	1	M. Tu. W. 8-10, or Th. F. S. 8-10	Elec. Eng.
14	3	Adv. Machine Work	3	1	M. Tu. Th. 10-12; or M. Tu. 1-4	Mech. Eng.
14	3	Adv. Machine Work	2	3	W. Th. 1. 4.	Short Ind. Arts.
14	3	Adv. Machine Work	3	3	M. Tu. Th. 10-12	Manual Train.
14	3	Adv. Machine Work	3	3	M. Tu. 1-4	Ind. Arts.
15	3	Adv. Machine Work	4	1	F. 1-4; S. 8-11	Ind. Arts. Man. Tr.
15	4	Adv. Machine Work	3	2	M. Tu. Th. F. 10-12; or F. 1-5, S. 8-12	Mech. Eng.
16	3	Adv. Machine Work	4	2	M. W. F. 8-10	Ind. Arts. Man. Tr.
17	3	Adv. Machine Work	4	3	M. Tu. 1-4	Ind. Arts.

Spanish

(DEPARTMENT OF ROMANCE LANGUAGES AND LITERATURES.)

Office, University Hall, Room 35.

PROFESSOR BOWEN ASSISTANT PROFESSOR INGRAHAM.

1. Elementary Spanish. Grammar and reader; modern stories and plays; composition and conversation. Four credit hours. First, second and third terms, M., Tu., Th., F., 11; or Tu., W., Th., F., 3. Offered as an alternative with French 1 and German 1 to those who enter with full or partial credit in Latin or Greek or without previous language training. ASSISTANT PROFESSOR INGRAHAM.

Enrollment

May 16, 1905

STUDENTS IN FOUR-YEAR COURSES LEADING TO DEGREES -	663
STUDENTS IN SHORT COURSES NOT LEADING TO DEGREES -	44
SPECIAL STUDENTS - - - - - - - - - - - - - - - - -	35
TOTAL - - - - - - - - - - - - - - - - - - -	742

Classification by Courses

Name of Course Pursued	4th Year	3rd Year	2nd Year	1st Year	2nd Year, Short	1st Year, Short	Special	Total
Unclassified	....	....	....	254	....	....	....	254
Architecture	1	3	10	Unclassified	....	....	....	14
Ceramics	2	4	12		4	10	....	32
Chemical Engineering	1	3	11		....	....	....	15
Civil Engineering	21	30	68		....	....	....	119
Electrical Engineering	22	32	54		....	....	....	108
Industrial Arts	....	1	1		6	15	....	23
Manual Training	....	....	2		....	....	....	2
Mechanical Engineering	22	27	36		....	....	....	85
Mining Engineering	10	15	21		1	8	....	55
Special, Unclassified	....	....	....	....	....	....	35	35
Total	79	115	215	254	11	33	35	742

NOTE:—For list of names, consult the General Catalogue of the University, which will be sent on application.

Summary of Graduates

Architecture (C. E. in Arch.)	3
Ceramics (E. M. in Ceramics)	8
Chemistry (B. Sc. in Chemistry)	24
Civil Engineering (C. E.)	132
Electrical Engineering (M. E. in E. E.)	135
Industrial Arts (B. Sc. in Ind. Arts)	2
Mechanical Engineering (M. E.)	105
Mining Engineering (E. M.)	67
Master of Science, Conferred by College of Engineering	2
Total Degrees Conferred	478
Names Counted Twice	8
Total Number of Graduates	470

Directory of Graduates

May 1, 1905

The faculty of the College of Engineering are anxious to place a copy of each annual catalogue in the hands of their graduates. They will esteem it a favor if any alumnus who changes his residence will notify the Secretary of the College of the new address and occupation. They will also be grateful for any information from any sources, that may assist in making or keeping the Directory of the Alumni complete and correct.

A

Ackerman, Eli O., 1884, C. E. Station "B," Columbus, Ohio.	Engineer, Maintenance of Way, Columbus Railway & Light Co.
Ackerman, Fremont, 1883, C. E. Los Angeles, California.	Civil Engineer.
Aldrich, Edgar S., 1897, E. E. Moscow, Idaho.	Vice President and Manager, Moscow Electric Light & Power Co.
Alexander, C. P., 1896, E. E. Canton, Ohio.	Instructor in Physics, Canton High School.
Alexander, St. C., 1893, E. E. Kansas City, Mo.	In Stock Yards.
Alsdorf, Fred. C., 1892, E. M. Clifton, Arizona.	Superintendent, Stevens Copper Co.
Alsdorf, Percy Reed, 1896, E. M. Central City, Colorado.	In Standard Assay Office.

Alsdorf, Robert C., 1904, M. E. Huntington, W. Va.	In Motive Power Dept., C. & O. R. R.
Ames, Edward H., 1903, C. E. Allegheny, Pa.	Assistant on Engineering Corps, P., F., W. & C. R. R.
Arnold, Edwin E., 1898, M. E. East Pittsburg, Pa.	Engineer, Westinghouse Machine Company.
Atkinson, Warren, 1899, M. E. Brooklyn, N. Y.	Maintenance Dept., New York Telephone Co.
Auld, James A., 1897, E. E. Columbus, Ohio.	With D. L. Auld.

B

Bailey, Ervin G., 1903, M. E. Fairmount, W. Va.	With Fairmount Coal Co.
Barcus, Miner, 1897, E. E. Schenectady, N. Y.	Assistant, Engineering Dept., General Electric Co.
Barnaby, C. L., 1898, C. E. Chicago, Ill.	Assistant Engineer, Maintenance of Way Dept., Penn. Lines.
Barringer, L. E., 1902, E. M. (Cer.) Schenectady, N. Y.	In Research Dept., General Electric Co.
Barrows, Harry H., 1898, C. E. Cincinnati, Ohio.	Road Master, Cincinnati Div., C., N. O. & T. P. Ry.
Barry, William J., 1903, C. E. Doanville, Ohio.	With C., H. & C. St. Ry.
Beach, David Price, 1895, C. E. Zanesville, Ohio.	Engineer Maintenance of Way, C. & M. V. Ry.
Beach, Howard L., 1904, E. E. Pittsburg, Pa.	In Testing Dept., Westinghouse Elec. Mfg. Co.
Beck, Arthur A., 1893, C. E. Columbus, Ohio.	Third Assistant City Engineer.
Belden, Sanford B., 1895, E. M. Pittsburg, Pa.	Manager Pittsburg Office, Jeffrey Manufacturing Co.
Benedict, E. W., 1904, E. E. Columbus, Ohio.	With Col. Ry. & Light Co.
Biebel, Herman M., 1896, E. E. Chicago, Ill.	Designing Electrical Engineer, Western Electric Co.
Bischoff, John W., 1899, E. M. Washington, D. C.	322 I Street, S. W.
Bissing, William, 1893, E. E. 49 Wall St., New York City.	Patent Attorney.
Blackburn, F. H., 1896, E. E. Fostoria, Ohio.	Superintendent, Fostoria Incandescent Lamp Co.
Bleininger, A. V., 1901, B. Sc. (Chem.) Columbus, Ohio.	Assistant Professor of Ceramics, Ohio State University.
Bloom, J. George, 1899, C. E. Chicago, Ill.	Principal Assistant Engineer, C., R. I. & P. Ry.
Bostater, H. L., 1904, E. E. Dayton, Ohio.	With The National Cash Register Co.

Bowden, Harry W., 1900, C. E. Mt. Vernon, Ohio.	Draftsman, Mt. Vernon Bridge Company.
Boehme, Adolph J., 1901, M. E. Youngstown, Ohio.	Engineer with the Youngstown Iron Sheet and Tube Co.
Bomesberger, W. N., 1903, E. M. Byesville, Ohio.	With Willes Creek Coal Co.
Boothman, Dale R., 1903, M. E. Bellaire, Ohio.	Apprentice Machinist.
Bostwick, Oliver N., 1902, C. E. Wheeling, W. Va.	With U. S. Tube Co.
Bott, George R., 1901, M. E. Muncie, Ind.	With Muncie Wheel & Journal Company.
Bower, Jerome G., 1897, M. E. Chicago, Ill.	Sales Agent, Pressed Steel Car Company.
Bradford, Joseph N., 1883, M. E. Columbus, Ohio.	Professor of Architecture and Drawing, Ohio State University.
Brannon, T. H., 1903, C. E. Columbus, Ohio.	In City Engineer's Office.
Brashear, E. R., 1903, C. E. Mt. Vernon, Ohio.	Draftsman, Mt. Vernon Bridge Works.
Bridgman, B. L., 1904, C. E. Columbus, Ohio.	Assistant on Engineer Corps, Hocking Valley R. R.
Britton, Guy, 1904, C. E. Columbus, Ohio.	Assistant, Sewage Disposal Testing Plant.
Britton, Lloyd C., 1902, C. E. Wyalusing, Pa.	Transitman, N. Y., P. & S. W. Railway.
Brooks, Herbert B., 1903, E. E. Washington, D. C.	Laboratory Assistant, Bureau of Standards.
Brophy, James F., 1899, E. M. Frostburg, Md.	
Brown, Fred W., 1888, E. M. Portland, Col.	Chemist, The Portland Cement Company.
Brown, John Q., 1898, M. E. Oakland, Cal.	Assistant General Manager and Engineer, Oakland Transit Co., and San Francisco, Oakland & St. Jose R. R.
Brown, Newton H., 1893, E. E. College Station, Tex.	Professor of Physics and Electrical Engineering, A. & M. College, Texas.
Brumley, Daniel J., 1895, C. E. Chicago, Ill.	Principal Assistant Engineer, Illinois Central R. R. Co.
Bruning, Henry D., 1896, C. E. Columbus, Ohio.	Assistant Professor in Civil Engineering, Ohio State University.
Buchenberg, A. E., 1900, E. E. Sandusky, Ohio.	Engineer, Warren Electric Mfg. Co.
Buckman, A. L., 1897, E. E. Toledo, Ohio.	Superintendent of Equipment, Toledo Home Telephone Co.
Burns, James F., 1891, C. E. Lebanon, Ky.	Engineer, Louisville & Nashville R. R.

Burrell, Glenn S., 1904, C. E.. Mt. Vernon, Ohio.	In Mt. Vernon Bridge Works.
Bygate, Harry G., 1899, M. E.. Niagara Falls, N. Y.	Assistant Superintendent, Upper Works, Pittsburg Reduction Co.

C

Calkins, George H., 1895, E. E. 44 Broad St., New York City.	Salesman, Mill Power Dept., General Electric Co.
Cameron, Harry E., 1901, C. E. Wilkinsburg, Pa.	In Designing and Estimating Dept., McClintic Marshall Construction Co.
Cameron, Gaylor M., 1904, E. E. Cleveland, Ohio.	With Cleveland Controller and Supply Co.
Capron, M. F., 1888, M. E..... Detroit, Mich.	Chief Mechanical Engineer, Seamless Steel Tube Co.
Carr, Hugh Stanley, 1896, E. E. Constantine, Mich.	Consulting Engineer, Constantine Hydraulic Co.
Carroll, Patrick H., 1894, E. M. Herrin, Illinois.	Superintendent, Big Muddy Coal & Iron Co.
Carson, Samuel K., 1895, E. E. Washington, D. C.	Acting Assistant Surgeon, U. S. A.
Cartzdafner, R. E., 1903, M. E. Columbus, Ohio.	With Case Mfg. Co.
Cavanaugh, A. F., 1900, M. E.. Milwaukee, Wis.	Draftsman, F. M. Prescott Steam Pump Co.
Cavin, Frank T., 1902, E. E... Schenectady, N. Y.	With General Electric Co.
Cellarius, Fred. J., 1888, C. E.. Dayton, Ohio.	Assistant City Engineer.
Chaffin, W. W., 1904, C. E.... Columbus, Ohio.	Assistant on Engineer Corps, Indianapolis Div., Penn. Lines.
Chambers, Wm. R., 1904, M. E. Lynn, Mass.	In Testing Dept., General Electric Co.
Chappell, Walter E., 1898, E.E. Trafford Pk., Manchester, Eng.	With the British Westinghouse Electric Co. L't'd.
Chubb, C. St. J., 1904, C. E., (Arch.) Columbus, Ohio.	Draftsman with F. L. Packard, Architect.
Chubb, Joseph H., 1904, C. E.. Columbus, Ohio.	In City Engineer's Office.
Cilley, Raymond, 1896, M. E... Middletown, Conn.	Chief Draftsman, Eisenhoth Horseless Vehicle Co.
Clark, Thomas W., 1904, E. M., (Cer.) New Brunswick, N. J.	With the Reconstructed Granite Co.
Clarke, C. J., 1899, C. E........ Columbus, Ohio.	Draftsman, City Engineer's Office.
Clarke, James U., 1902, E. E.. Lancaster, Ohio.	Superintendent Lancaster Traction Co.

Coddington, E. F., 1896, C. E.; 1897, M. Sc.; 1902, Ph. D., University of Berlin. Columbus, Ohio.	Assistant Professor of Mathematics, Ohio State University.
Cole, George N., 1891, E. E.... 265 Broadway, New York City.	Contractor, Railroad Supplies.
Collins, Curtis, 1895, E. E.... San Juan, Porto Rico.	Consulting Engineer for S. A. Luz Electrica and Rio Electric Co.
Conley, Clyde, G., 1902, C. E. Mt. Vernon, Ohio.	Estimator, Mt. Vernon Bridge Co.
Connell, Wm. A., 1886, E. M.. Kansas City, Mo.	In Medical College.
Conrad, Louis Verne, 1902, C. E. Xenia, Ohio.	Assistant on Engineers' Corps, P., C., C. & St. L. R. R.
Conway, Hugh L., 1896, C. E.. Cincinnati, Ohio.	Assistant City Engineer.
Cook, Spencer N., 1903, E. M... Carbondale, Iowa.	Chief Engineer, Smith-Lowe Coal Co.
Cope, Albert N., 1897, E. E.... Columbus, Ohio.	Chief Electrician, Columbus Public Service Co.
Cosley, Harvey H., 1901, C. E.. Chicago, Illinois.	Salesman, Cambria Steel Co.
Coulter, Leonard B., 1904, E.M. (Cer.) Columbus, Ohio.	With Prof. Edward Orton, Jr., Clay Testing and Mfg. Clay Specialties.
Covell, Vernon R., 1895, C. E.. Pittsburg, Pa.	Superintendent, Penn. Heat and Power Co.
Crable, Arthur, 1901, C. E..... Cleveland, Ohio.	Engineer, Maintenance of Way Dept., Erie Ry. Co.
Crocker, T. D., 1904, E. E.... Milwaukee, Wis.	With Electric Ry. & Light Co.
Crooks, Thomas E., 1904, M. E. Lynn, Mass.	In Testing Dept., General Electric Co.
Cunningham, E. W., 1894, C. E. Ambridge, Pa.	With American Bridge Co.
Curtis, Leigh G., 1899, C. E... Chicago, Illinois.	Division Engineer, Chicago Division, B. & O. R. R.

D

Damron, Carson W., 1897, M. E. Pittsburg, Pa.	Engineer, Heyl & Patterson, Contracting Engineers.
Dann, Walter M., 1902, E. E... Pittsburg, Pa.	With Westinghouse Electric & Manufacturing Co.
Davis, Charles W., 1894, E. M. Colorado Springs, Col.	Davis-McCuan Investment Co.
Davis, Oscar Allen, 1897, E. E. Alliance, Ohio.	Mechanical Engineer, Reeves Bros. Co.
Deahl, Walter S., 1896, C. E.. Johnstown, Pa.	Draftsman, Cambria Steel Co.

DeLoffre, Andre, 1896, E. E.... London, E. C., England.	Electrical Engineer for General Electric Co. of America.
DeWolf, R. D., 1901, E. E...... Pittsburg, Pa.	Electric Engineer, Westinghouse Electric & Manufacturing Co.
Denny, Chas. W., 1901, E. E.. New York, N. Y.	In Experimental Department, Cooper Hewitt Electric Co.
Diemer, Hugo, 1896, E. E....... Cincinnati, Ohio.	Consulting Engineer.
Dill, Raymond, 1901, E. E..... Milwaukee, Wis.	In Correspondence Dept., Allis-Chalmers Co.
Donham, M. D., 1896, M. E... Warren, Pa.	Vice President and Chief Engineer, Jacobson Machine Mfg. Co.
Dorsey, Walter A., 1904, M. E. Lynn, Mass.	In Testing Dept., General Electric Co.
Doty, Oliver P., Jr., 1904, E. M. Hanging Rock, Ohio.	
Drummond, Wm. G., 1900, M.E. Bryan, Texas.	Assistant Professor of Mechanical Engineering, A. & M. College of Texas.
Dun, John J., 1883, E. M...... Columbus, Ohio.	Real Estate Agent.
Dunlap, T. C., 1895, E. E...... Columbus, Ohio.	Manager Columbus Pneumatic Tool Co.
Dunlop, Robert R., 1900, E. E. Columbus, Ohio.	Electrical Engineer, Jeffrey Manufacturing Co.
Dunnick, Edward, 1897, C. E.. Wheeling, W. Va.	Contracting Engineer, W. Va. Bridge & Construction Co.
Dupuy, B. F., 1904, C. E......	

E

Emswiler, John E., 1903, M. E.. Schenectady, N. Y.	In Steam Turbine Dept., General Electric Co.
Erskine, James H., 1886, E. M., M. D. Albany, Oregon.	Physician and Surgeon.
Estep, Frank L., 1898, E. E... Bridgeport, Conn.	Foreman Copper Rolling Mill, Bridgeport Brass Co.
Evans, Peter P., 1892, C. E... Osborn Bldg., Cleveland, O.	Contracting Engineer, The Osborn Engineering Co.
Eysenbach, E. E., 1896, E. M.. St. Paul, Minn.	Superintendent, St. Paul Gas Light Co.
Eysenbach, Louis Jr., 1903, C.E.	Died January 20, 1904.

F

Feicht, Edward R., 1904, M. E. Pittsburg, Pa.	With Westinghouse Machine Co.
Feicht, Russell S., 1890, E. E.. Pittsburg, Pa.	Head of Industrial Division, Engineering Dept., Westinghouse Electric & Mfg. Co.

Fergus, Guy C., 1898, E. E... Zanesville, Ohio.	Partner, Zanesville Electric Co.
Fickes, Walter M., 1900, E. M. (Cer.) Carnegie, Pa.	Manager of the Rosslyn Brick Co.
Fish, Fred Alan, 1898, E. E... Ames, Iowa.	Associate Professor of Electrical Engineering, Iowa State College.
Floto, Julius, 1889, E. M...... Chicago, Ill.	Manager, Chicago Office of Columbian Fireproofing Co.
Flynn, Harry F., 1892, C. E.. Manila, P. I.	Chief Surveyor, Bureau of Public Lands.
Ford, Nile Otis, 1901, E. M.; 1897, A. B.; 1900, M. S., W. & J. 42 Broadway, New York City.	Bradley, Ford & Co., Mining Engineers.
Foster, Frank M., 1894, E. E... Cincinnati, Ohio.	Secretary and Treasurer, American Valve and Meter Co.
Foster, Vause, 1903, E. M..... Gary, McDowell Co., W. Va.	With U. S. Coal & Coke Co.
Fowler, Harry R., 1894, E. E.. Toledo, Ohio.	Electrical Engineer and Contractor.
Fox, John Herbert, 1897, M. E. Cleveland, Ohio.	Mechanical Engineer, Estimating and Designing Dept., The Brown Hoisting Machinery Co.
Frame, Rollo S., 1901, C. E.... Pittsburg, Pa.	Assistant on Engineers' Corps, Penn. Lines.
Frankenberg, G. T., 1902, M. E. Columbus, Ohio.	Assistant Master Mechanic, Columbus Iron & Steel Co.
Frankenberg, J. T., 1899, E. E. Pittsburg, Pa.	Special Assistant Engineer, C., D. & P. Telephone Co.
Fravel, George B., 1888, M. E.. Chicago, Ill.	Master Mechanic, Chicago Terminal Division, Penn. Lines.
Frayer, Lee A., 1896, M. E.... Columbus, Ohio.	Of Frayer & Miller, Motor Cycles.
Frechtling, Arthur, 1901, M. E. Hamilton, Ohio.	
Freeman, S. S., 1898, E. M... Parryville, Pa.	Superintendent, Carbon Iron & Steel Co.
French, Thomas E., 1895, M.E. Columbus, Ohio.	Associate Professor of Architecture and Drawing, Ohio State University.
Frost, George W., 1900, M. E.. Columbus, Ohio.	Sales Manager, Columbus Storage Battery Co.
Fuller, Charles W., 1904, E. M. Copper Mountain, Alaska.	Metallurgist.

G

Gallen, William F., 1897, M. E. Columbus, Ohio.	Foreman of Drafting Room, Case Manufacturing Co.

Gamper, Herman, 1899, M. E. Xenia, Ohio.	Superintendent, Mechanical and Electrical Dept., O. S. & S. O. Home.
Garber, John M., 1897, C. E. Wheeling, W. Va.	Chief Draftsman, W. Va. Bridge & Construction Co.
Gee, Eugene, C., 1897, E. E. Seattle, Wash.	Assistant Electrical Engineer, Bell Telephone Co.
Gehrkens, E. F., 1894, E. E. Schenectady, N. Y.	With General Electric Co.
Given, James Byron, 1896, E. E. Chicago, Illinois.	In Telephone Dept., Western Electric Co.
Goddard, Loring H., 1892, C. E. R. F. D. No. 5, Washington C. H., Ohio.	Farmer.
Goodell, Ralph S., 1892, C. E. Mt. Vernon, Ohio.	Principal Assistant Engineer, Mt. Vernon Bridge Co.
Gould, William S., 1904, M. E. Lynn, Mass.	In Steam Turbine Testing Dept., General Electric Co.
Graham, Emery E., 1898, E. E. Cleveland, Ohio.	Draftsman, Wellman - Seaver-Morgan Engineering Co.
Grate, Charles A., 1898, M. E. Cleveland, Ohio.	With Interstate Engineering Co.
Green, Jerome J., 1893, E. E. Notre Dame, Indiana.	Professor of Physics and Electrical Engineering, University of Notre Dame.
Green, Joseph F., 1899, E. E. Moline, Illinois.	Electrical Engineer, Moline Elec. Elev. Co.
Gregory, Hiram D., 1880, E. M. Covington, Ky.	Attorney-at-Law.
Griffin, Mark H., 1897, E. E. Spitzer Bldg., Toledo, Ohio.	Real Estate Agent.
Groves, John W., 1898, C. E. Barberton, Ohio.	Draftsman, Columbia Chemical Co.
Gwynne, Josiah W., 1904, E. E. Pittsburg, Pa.	In Testing Dept., Westinghouse Elec. & Mfg. Co.

H

Haas, Frank, 1895, C. E.: 1896, E. M. Fairmount, W. Va.	Chemist, Fairmount Coal Co.
Hale, Frederick J., 1898, M. E.: 1900, M. Sc. Pittsburg, Pa.	Designer, Westinghouse Machine Co., Gas Engine Department.
Hall, Harry R., 1889, E. M. Sault Ste Marie, Ontario, Can.	Superintendent Blast Furnaces, The Lake Superior Power Co.
Hamilton, Ross E., 1903, C. E. Wyalusing, Pa.	Transitman, N. Y., P. & S. W. Ry.
Hammond, John M., 1902, C. E Mattoon, Ill.	Assistant in Construction Dept., C., C., C. & St. L. R. R.

Hance, Harry T., 1901, B. Sc. (Chem.) Columbus, Ohio.	Manager, Hance-Brown Casting Co.
Hapgood, Eugene P., 1902, B. Sc. (Chem.) Salt Lake City, Utah.	Assistant, Maintenance of Way Dept., S. P., L. Q. & S. L. R. R.
Hardy, Paul, 1904, E. M. 46 S. Sixth St., Columbus, O.	
Harkins, Robert R., 1900, M. E. New York City.	With Atlas Engine Co.
Harrison, Wm. H., 1885, C. E. Columbus, Ohio.	Railway Engineer.
Harrop, Carl B., 1902, E. M. Columbus, Ohio.	Draftsman with W. D. Richardson.
Hartwell, Arthur, 1888, M. E. Pittsburg, Pa.	Sales Manager, Westinghouse Electric & Manufacturing Co.
Hartwick, Louis M., 1897, M. E. Pueblo, Col.	Master Mechanic, Blast Furnace, C. F. & I Co.
Hassler, Robert H., 1892, E. E. Indianapolis, Ind.	Engineer, International Motor Car Co.
Hayman, Wm. C., 1900, E. E. Schenectady, N. Y.	Engineer, Wire & Cable Dept., General Electric Co.
Hayward, George E., 1893, C. E. Bronson, Mich.	General Manager, The Bronson Portland Cement Co.
Hazlett, Robert, Jr., 1887, C. E. Wheeling, W. Va.	Consulting Civil Engineer, and Chief Engineer, Pan Handle Traction Co.
Hebble, Charles R., 1896, E. E. Cincinnati, Ohio.	Special Agent, Penn Mutual Life Ins. Co.
Heller, Albert H., 1890, C. E. Columbus, Ohio.	Professor of Bridge Engineering, Ohio State University.
Helvey, George S., 1903, M. E. Chicago, Ill.	
Henderson, A. A., 1898, C. E. Pittsburg, Pa.	Engineer in County Engineer's Office.
Henretta Chas. M., 1896, E. M Bauff, Alberta.	In Mining and Metallurgical Dept., Canadian Pacific R. R.
Hertner, John H., 1899, E. E. Cleveland, Ohio.	Of Hertner Electric Co.
Hewitt, S. R., 1898, E. E. Columbus, Ohio.	With Kinnear Mfg. Co.
Hill, Cortland L., 1903, C. E. Connellsville, Pa.	Assistant an Engineers' Corps, B. & O. R. R.
Hine, Lucius A., 1888, E. M. Chicago, Illinois.	President and Treasurer, Hine-Watt Manufacturing Co.
Hipple, John M., 1893, E. E. Pittsburg, Pa.	Engineer, Westinghouse Electric & Manufacturing Co.
Hirsch, Gustav, 1897, E. E. Lima, Ohio.	Chief Engineer and Vice President, Ideal Construction Co.
Hirst, Harry, 1903, E. M. Dennison, Ohio.	Superintendent, Dennison Mining Co.

HITCH, JAMES F., 1902, C. E..... Williamson, W. Va.	Engineer, Ohio & Big Sandy Coal Co.
HITE, FLORENCE E., 1904, C. E.. (Arch.) Columbus, Ohio.	Draftsman with J. A. Jones, Architect.
HOLBROOK, GEORGE F., 1902, E.M. 595 D St., San Bernardino, Cal.	Surveyor.
HOLLOWAY, T. W., 1904, M. E... Scranton, Pa.	With International Correspondence Schools.
HOMAN, FRANK, 1895, C. E..... Carbon, W. Va.	Mining Engineer, Carbon Coal Co.
HOOD, WILLARD J., 1904, M. E... Huntington, W. Va.	In Motive Power Dept., C. & O. R. R.
HOWALD, FERD., 1878, B. Sc. 1881, E. M. Rush Run, Fayette Co., W. Va.	Coal Operator.
HOWE, ROY E., 1904, C. E....... Roosevelt, Idaho.	Assayer.
HOWELLS, E. S., 1884, E. M.... Birmingham, Ala.	President, Howells Mining Co.
HOWELLS, T. J., 1897, E. M Bluefield, W. Va.	Chemist in Pocahontas Coal Field for National Steel Co.
HUDDLESON, F. N., 1902, E. M.. Salt Lake City, Utah.	In Maintenance of Way Dept., S. P., L. Q. & S. L. Ry.
HULL, WALTER A., 1902, E. M. (Cer.) Bolivar, Pa.	Chemist, Reese-Hammond Fire Brick Co.
HUMPHREY, H. P., 1904, E. M. (Cer.) Trenton, N. J.	With Cook Pottery Co.
HUNT, WM. F., 1887, M. E.; 1895, LL. B.; 1896, LL. M. (Univ. of Minn.) St. Paul, Minn.	Attorney-at-Law.
HUNTER, JAMES W., 1904, C. E. Terre Haute, Ind.	Assistant on Engineers' Corps, Vandalia Div., Penn. Lines.
HUNTER, MADONE C., 1900, E. E. St. Joseph, Mo.	Electrical Engineer, St. Joseph Ry., Light, Heat & Power Co.
HUNTINGTON, A., 1899, M. E.... Chicago, Ill.	Engineer with Westinghouse Electric & Mfg. Co.
HYLE, CHARLES A., 1896, E. E... Minneapolis, Minn.	Observer, U. S. Weather Bureau.

I

IRELAND, GUY L., 1895, M. E....	
IRVIN, CHADWICK H., 1897, M. E. 41 Tecumseh St., Dayton, O.	

J

Jenkins, William G., 1893, C. E Bellefontaine, Ohio.	Draftsman, The Bellefontaine Bridge & Iron Co.
Jenkins, Willis H., 1894, C. E. Sheridanville, Pa.	Transitman, Pennsylvania Lines West of Pittsburg.
Jennings, Levi E., 1897, E. E. Dayton, Ohio.	With R. E. Kline, Consulting Engineer.
Johnson, Chas. W., 1896, E. E. Montreal, Canada.	Manager Electric Dept., Canadian Bullock Electric Mfg. Co., Ltd.
Johnson, Earl S., 1900, E. E. Schenectady, N. Y.	In Testing Department, General Electric Co.
Johnson, Walter A., 1902, M. E. Columbus, Ohio.	In Motive Power Dept., P., C., C. & St. L. Ry.
Johnston, George E., 1892, C. E. Louisville, Ky.	Assistant Engineer, L. & N. R. R.
Johnston, H. L., 1892, E. E. Troy, Ohio.	Manager Hobart Elec. Co.
Jones, Arthur J., 1898, E. E. Pittsburg, Pa.	Foreman, Testing Dept., Westinghouse Electric & Mfg. Co.
Jones, Houston, 1895, E. E. 604 Burlington Bldg, St. Louis, Mo.	Consulting Engineer.
Jones, Grandville R., 1904, C. E. Mt. Vernon, Ohio.	Draftsman, Mt. Vernon Bridge Works.
Jones, Pearl N., 1892, E. E. Pittsburg, Pa.	Manager, Pittsburg Sales Office, Westinghouse Electric & Mfg. Co.
Jones, Smilie, 1894, E. M. Prescott, Arizona.	
Judd, Horace, 1897, M. E. 1899, M. Sc. Columbus, Ohio.	Assistant Professor in Experimental Engineering, Ohio State University.
Judson, Walter R., 1903, M. E. Santa Barbara, Chihuahua, Mexico.	With Montezuma Lead Co.

K

Kalb, Warren C., 1904, E. E. Columbus, Ohio.	Mechanical Engineer, Columbus Pneumatic Tool Co.
Kanmacher, S. H., 1900, E. E. Schenectady, N. Y.	Engineer, Power & Mining Eng. Dept., General Electric Co.
Keating, H. T., 1902, B. Sc (Chem.) Columbus, Ohio.	Studying Law.
Keffer, Frederick, 1892, E. M. Anaconda, British Columbia.	General Manager, The British Columbia Copper Co., Ltd.

Kemmler, E. A., 1888, C. E.… Columbus, Ohio.	Assistant City Engineer.
Kern, William F., 1902, B. Sc. (Chem.) Columbus, Ohio.	Chemist, Buckeye Steel Casting Co.
Kerr, Samuel T., 1894, E. E.… Martins Ferry, Ohio.	Superintendent, Municipal Electric Light Plant.
Kester, Frederick E.,1895, E.E.; 1899, A. M. (Cornell.) Columbus, Ohio.	Associate Professor of Physics, Ohio State University.
Kettering, Chas. F., 1904, E. E. Dayton, Ohio.	Chief of Electrical Invention Dept., National Cash Register Co.
Kettler, Frank C., 1901, C. E. Chicago, Illinois.	In North Works, Illinois Steel Co.
Kiesewetter, L. F., 1891, C. E.; 1892, A. B. and 1893, A. M., (Harv.) Columbus, Ohio.	Cashier, The Ohio National Bank.
King, Herbert S., 1901, C. E.… Springfield, Ill.	Engineer of Construction, Springfield Colliery Co.
King, Roy S., 1902, M. E.…… Minneapolis, Minn.	Assistant Professor of Mechanical Engineering, Univ. of Minn.
Klie, Walter, 1903, M. E.…… Columbus, Ohio.	With Klie Plumbing Co.
Kline, Charles H., 1897, E. E. Dayton, Ohio.	Civil Engineer, with R. E. Kline, Consulting Engineer.
Knecht, Arthur E., 1898, M. E. Cincinnati, Ohio.	Mechanical Engineer, Cincinnati Screw and Tap Co.
Knight, Wm. Abner, 1900, M.E. Columbus, Ohio.	Assistant Professor of Machine-Shop Practice, Ohio State University.
Knox, Frank S., Jr., 1900, E. M. Buchtel, Ohio.	Engineer, Pittsburg Coal Co.
Krumm, Louis R., 1898, E. E.… Columbus, Ohio.	With Erner-Hopkins Co.
Krumm, Thomas Z., 1902, C. E. Fort Dodge, Iowa.	Instrument Man, C. & G. W. R. R.
Kuhn, Vallie H., 1896, E. E.… Etna, Ohio.	Machinist.
Kunkel, Fred. R., 1903, E. E.. Pittsburg, Pa.	Electrical Engineer, Westinghouse Elec. & Mfg. Co.

L

Lamb, Whitney E., 1900, E. E Schenectady, N. Y.	In Commercial Dept., General Electric Co.
Lamme, Benjamin G., 1888, M. E. Pittsburg, Pa.	Chief Engineer, Westinghouse Electrical & Mfg. Co.

Lamme, Bertha A., 1893, E. E. Pittsburg, Pa.	With Westinghouse Electric & Mfg. Co.
Large, Joseph H., 1890, C. E. Massillon, Ohio.	Draftsman, Massillon Bridge Co.
Lee, Corliss Edgar, 1900, E. E. Schenectady, N. Y.	With General Electric Co.
Lee, Robert M., 1897, M. E. Washington, D. C.	Draftsman, Ordnance Department, U. S. Army.
Leibold, Carl P., 1904, E. E. Columbus, Ohio.	Post Graduate Student at Ohio State University.
Lesh, John Howard, 1901, M. E. Cleveland, Ohio.	Chief Draftsman, Variety Iron Works Co.
Levering, O. D., 1893, M. E. Columbus, Ohio.	Foreman of Tool Room, Columbus Machine Co.
Lincoln, Paul M., 1892, E. E. Pittsburg, Pa.	Head of Power Div., Engineering Dept., Westinghouse Electric & Mfg. Co.
Linebaugh, Jesse J., 1899, E. E. Schenectady, N. Y.	Electrical Engineer, Testing Department, General Electric Co.
Linxweiler, Otto Z., 1903, M.E.	Died Feb. 19, 1904.
Linville, C. P., 1900, B. Sc. (Chem.), 1902, A. M. State College, Pa.	Instructor in Metallurgy, Pennsylvania State College.
Logan, L. L., 1896, E. M. Robertsdale, Pa.	General Superintendent, Rockhill Iron & Coal Co.
Long, George S., 1903, E. M. Gary, McDowell Co., W. Va.	With U. S. Coal & Coke Co.
Lott, Charles M., 1895, E. E. Hicksville, Ohio.	Proprietor and Superintendent of Hicksville Electric Light Plant.
Lovejoy, Ellis, 1885, E. M. New Lexington, Ohio.	General Manager, Imperial Clay Co.
Lyon, Arthur H., 1900, M. E. Bucyrus, Ohio.	Works Manager, New York Blower Co.

M

Manley, Rush E., 1894, E. E. Columbus, Ohio.	Chief Inspector, Central Union Telephone Co.
Marckworth, O. S., 1901, B. Sc. (Chem.) Columbus, Ohio.	Manager, Ohio Testing Laboratory.
Marker, James R., 1904, C. E. Greenville, Ohio.	County Surveyor.
Marquard, Frank F., 1896, C.E. Sharon, Pa.	Superintendent, The Sharon Coke Co.
Marshall, Chas. H., 1903, M. E. Fort Wayne, Ind.	With Western Gas Construction Co.
Marshall, W. B., 1900, E. E.	

Martin, George, 1897, E. E. Lorain, Ohio.	Special Inspector, Electrical Department, National Tube Co.
Martin, John D., 1901, M. E. Dennison, Ohio.	Special Apprentice, P., C., C. & St. L. Ry. Shops.
Martin, Ray M., 1904, M. E. Beloit, Wis.	In Gas Producer Dept., Fairbanks, Morse & Co.
Martin, Percy, 1892, E. E. Coventry, England.	General Manager, Daimler Motor Co.
Marvin, Charles F., 1883, M.E. Washington, D. C.	Professor of Meteorology, in Charge Instrument Division, U. S. Weather Bureau.
Masters, George A., 1886, C. E. Topeka, Kansas.	Assistant Bridge Engineer, A. T. & S. F. Ry. System.
Matson, William E., 1896, E. E. Lynn, Mass.	In Production Dept., General Electric Co.
McAllen, Wm. J., 1894, C. E. Chicago, Illionis.	Civil Engineer, Structural Dept., North Works, Illinois Steel Co.
McCarter, R. D., Jr., 1895, E. E. London, E. C., England.	Manager and Engineer, Bath Electric Tramway, Ltd.
McComb, Hoyt S., 1904, E. M. Santoy, Ohio.	Chief Engineer, New England Coal Co.
McCormick, J. H., 1880, M. E. 1354 Fair Ave., Columbus, O.	Mechanical Engineer.
McCormick, W. F., 1896, M. E. Columbus, Ohio.	With Buckeye Malleable and Steel Casting Co.
McFarland, H. M., 1902, E. M. Birmingham, Ala.	Assistant Mining Engineer, Tennessee Coal & Iron Co.
McGarey, Leo S., 1904, E. E. Columbus, Ohio.	With Scioto Valley Traction Co.
McGrew, John A., 1895, C. E. Columbus, Ohio.	Consulting and Contracting Engineer.
McGuffey, F. H., 1894, E. E. Columbus, Ohio.	Clerk in Railway Mail Service.
McIntire, Alfred H., 1898, E. E.; 1900, M. E. Care of McIntire & McIntire, Mt. Vernon, Ohio.	
McIntosh, Roscoe E., 1902, E.E. Los Angeles, Cal.	Consulting Electrical Engineer, with R. S. Masson.
McKeon, Robert D., 1902, C. E. Logansport, Ind.	Assistant on Engineers' Corps, Logansport Div., P., C., C. & St. L. Ry.
McNary, G. B., Jr., 1896, E. E. Toledo, Ohio.	Purchasing Agent, F. Bissell Co.
Meiklejohn, Robert, 1904, M.E. Chicago, Illinois.	With Illinois Steel Co.
Melick, Cyrus A., 1903, C. E. Kansas City, Mo.	Draftsman, K. C., M. & O. R. R.
Melick, Neal A., 1900, C. E. New York City.	Assistant Engineer, N. Y., C. & H. R. R. R.

Menough, A. G., 1894, E. M. Wellsville, Ohio.	Secretary and Treasurer, Menough Iron & Steel Fdry. Co.
Mercer, Frank E., 1896, E. E. San Francisco, Cal.	With Risdon Iron and Locomotive Works.
Mercer, Robert W., 1903, E. M. Gary, McDowell Co., W. Va.	Computer, U. S. Coal & Coke Co.
Merrill, Ernest M., 1902, C. E. Lester, W. Va.	General Manager, Micajah Coal & Coke Co.
Mershon, Ralph D., 1890, M. E. 24 Broadway, New York City.	Consulting Engineer.
Miller, Albert A., 1902, C. E. Baltimore, Md.	Assistant Engineer to Chief Engineer, Maintenance of Way, B. & O. R. R.
Miller Frank Case, 1893, C. E. Sacramento, Cal.	Resident Engineer, Sacramento Div., Southern Pacific Ry. Co.
Miller, Henry F., 1889, M. E. 345 E. State St., Columbus, O.	Consulting Engineer.
Miller, Ralph C., 1901, C. E. Columbus, Ohio.	In Maintenance of Way Dept., Indianapolis Div., P., C., C. & St. L. Ry.
Minor, Wells H., 1903, E. M. Box 124, Central City, Ky.	Mining Engineer, Central Coal & Iron Co.
Minton, LeRoy H., 1904, E. M. (Cer.) Mineral City, Ohio.	With C. Edwards Holden.
Mooney, George L., 1903, E. E. Pittsburg, Pa.	In Testing Dept., Westinghouse Elec. & Mfg. Co.
Morlan, Wilbert, 1903, M. E. West Allis, Wis.	Special Apprentice, Allis-Chalmers Co.
Morris, Clyde T., 1898, C. E. Cleveland, Ohio.	Engineer, King Bridge Co.
Morris, Robert H., 1901, E. M. Glouster, Ohio.	Engineer, Continental Coal Co.
Morris, Willard B., 1903, M. E. Columbus, Ohio.	With C. E. Morris & Co., Structural Steel Works.
Morris, William B., 1902, M. E. Mt. Vernon, Ohio.	Draftsman, C. & G. Cooper Co.
Morrison, Robert O., 1893, C. E. Zanesville, Ohio.	Assistant Engineer, C. & M. V. R. R.
Morton, George L., 1884, M. E. Washington, D. C.	Principal Examiner, Instruments of Precision, U. S. Patent Office.
Munn, Mortimer A., 1894, C. E. Cleveland, Ohio.	Civil Engineer, Roberts & Abbott Co.
Murphy, Joseph L., 1903, C. E. Floodwood, Ohio.	Mining Engineer, N. Y. Coal Co.
Myers, Albert B., 1900, E. M. Tepezala, Aguascalientes, Mex.	Engineer and Foreman, Minas Tepezalanas.
Myers, Ord, 1895, E. E. New York City.	Electrician, Metropolitan Street Railway Co.

Myers, Roy V., 1893, C. E..... Dayton, Tenn.	Superintendent Mines, Dayton Coal & Iron Co., Ltd.
Myers, Uriah H., 1887, E. M.. Pittsburg, Pa.	Printer and Stationer, Myers & Shinkle.

N

Nagel, William G., 1895, M. E. Toledo, Ohio.	President and Manager, W. G. Nagel Electric Co.
Nauss, Ralph W., 1901, B. Sc. (Chem.) Columbus, Ohio.	Student, Northwestern University Medical School.
Needham, Harry S., 1900, M. E. Dennison, Ohio.	General Assistant Foreman, P., C., C. & St. L. R. R. Shops.
Nesbitt, Chas. E., 1904, B. Sc. (Chem.) 321 Boren Ave., Seattle, Wash.	Chemist for Rubber Works.
Newton, Samuel D., 1985, C. E. Knoxville, Tenn.	Civil Engineer, Southern Ry. Co.
Nichols, Harry B., 1903, C. E. Wheeling, W. Va.	Assistant on Engineers' Corps, B. & O. R. R.
Nicholson, C. M., 1900, E. E.. Cincinnati, Ohio.	Foreman on Testing and Constructing Depts., Bullock Elec. Mfg. Co.
Nidy, Herbert C., 1901, E. E... Lynn, Mass.	With General Electric Co.
Nold, John H., 1900, E. M..... Columbus, Ohio.	Mine Engineer, Assistant to F. A. Ray.
Nurian, Kerson, 1899, M. E... St. Louis, Mo.	With Engineering Dept., Missouri Pacific Ry.
Nye, Ralph D., 1903, E. E.... Pittsburg, Pa.	In Testing Dept., Westinghouse Elec. & Mfg. Co.

O

O'Brine, David, 1881, B. Sc., M. Sc.; 1882, E. M., D. Sc., M. D. Urbana, Ohio.	Physician and Surgeon.
Orndorf, Earl L., 1903, B. Sc. (Chem.) Cincinnati, Ohio.	Assistant Chemist, Proctor & Gamble Co.
Orton, Edward, Jr., 1884, E. M. Columbus, Ohio.	Professor of Ceramics, Ohio State University, State Geologist of Ohio.

P

Pabodie, Robert J., 1899, M. E.. Philadelphia, Pa.	Mechanical Engineer, Bureau of Filtration.

PALMER, WALTER K., 1893, M. E. 402 Lyceum Building, Kansas City, Mo.	Consulting Mechanical and Electrical Engineer.
PARRETT, BENJ. C., 1902, B. Sc. (Chem.) McKee's Rock, Pa.	Chief Chemist, Penn. Malleable Co.
PATCH, HOMER A., 1896, C. E... Minneapolis, Minn.	Draftsman, Minneapolis Steel & Machinery Co.
PAYNE, HALBERT E., 1887, M. E. New York City.	President, American Typewriter Co.
PEARL, ALLEN S., 1894, E. E.... Chicago, Illinois.	Manager, Specialty Dept., Central Electric Co., Chicago, Ill.
PEDLOW, EDWARD B., 1893, C. E.	Died January 6, 1904.
PEIRCE, JOHN M., 1895, E. E.... Los Angeles, Cal.	With Home Telegraph & Telephone Co.
PELTON, FORREST B., 1904, E. E. Schenectady, N. Y.	In Testing Dept., General Electric Co.
PEPPEL, SAMUEL V., 1899, B. Sc. (Chem.) 431 W. Main St., Louisville, Ky.	In Editorial Work.
PETERS, WILLIAM L., 1885, M. E. Riverside, Cal.	Horticulturist.
PETERSON, JOHN W., 1903, C. E. in Arch. Pittsburg, Pa.	Inspector, Chief Engineer's Office, P., C., C. & St. L. Ry.
PLEUKHARP, C. V., 1885, M. E.. La Crescenta, Cal.	Clergyman.
POLK, WALTER C., 1895, C. E... Kansas City, Mo.	Engineer, Central Construction Co.
POSTLE, HERMAN R., 1894, C. E. Pasadena, Cal.	Civil Engineer.
POTO, FRANK B., 1901, B. Sc. (Chem.) Sta. C, Columbus, Ohio.	Chemist, Carnegie Steel Co.
POWELL, CHARLES S., 1893, E. E. 11 Pine St., New York City.	General Agent, Westinghouse Electric & Mfg. Co.
POWELL, IVAN E., 1904, E. E.... Rochester, N. Y .	Engineering Assistant, Rochester Ry. & Light Co.
PRATT, FRED KELLOGG, 1900, C. E. Colorado Springs, Col.	Principal, "Curtis School."

R

RAWSON, LEVI, 1899, C. E....... Sistersville, W. Va.	Engineer, Carter Oil Company.
RAY, FRANK A., 1887, E. M.... 137 King Ave., Columbus, O.	Professor of Mine Engineering, Ohio State University.
RAY, WILLIAM M., 1893, C. E.. Cleveland, Ohio.	Assistant Engineer, B. & O. R. R. Co.
RAYMOND, COLES A., 1894, C. E.. Toledo, Ohio.	Draftsman, American Bridge Co

Reed, G. Nathaniel, 1903, M. E. Indianapolis, Ind.	With International Vehicle Co.
Reed, Robert B., 1896, E. E..... Ft. Wayne, Ind.	Engineer, Ft. Wayne Electric Works.
Reed, William A., 1897, E. M.. Telluride, Col.	Assistant Superintendent, Liberty Bell Gold Mining Co.
Ribot, Antonio y C., 1904, E. E. Schenectady, N. Y.	With General Electric Co.
Rice, Herbert A., 1897, C. E... So. Bethlehem, Pa.	Instructor in Civil Engineering, Lehigh University.
Rice, Ray H., 1904, C. E...... Columbus, Ohio.	
Riddile, John S., 1904, E. E... Pittsburg, Pa.	With Westinghouse Electric & Mfg. Co.
Riddle, Howard S., 1897, E. E.. Columbus, Ohio.	Engineer, Jeffrey Mfg. Co.
Rightmire, R. E., 1902, M. E... Columbus, Ohio.	Special Apprentice, Hocking Valley Railway Co.
Ritchie, George A., 1903, C. E.. Columbus, Ohio.	Inspector, Sewage Disposal Plant.
Roberts, Cyrus S., 1898, E. M..	Died November 15, 1903.
Robinson, Erdis G., 1893, C. E.. Columbus, Ohio.	Secretary and Treasurer, Robinson-Tilton Machinery Co.
Rogers, James B., 1896, E. M.. Leetonia, Ohio.	Assistant Superintendent, Salem Iron Co.
Root, Willis J., 1885, E. M.... Columbus, Ohio.	General Superintendent, National Steel Co., Columbus, Works.
Ross, Calvin B., 1903, E. E.... Springfield, Ohio.	Engineer and Draftsman, Hopper Mfg. Co.
Rowlee, Henry A., 1897, M. E. Philadelphia, Pa.	Inspector of Ordnance, U. S. A., Midvale Steel Works.
Royon, Eduoard D., 1904, M. E. Lynn, Mass.	In Testing Dept., General Electric Co.
Ruhlen, Carl M., 1898, M. E.. Port Townsend, Wash.	Superintendent of Construction, Quartermaster's Dept., U. S. Army.
Ryland Paul D., 1901, C. E.. Bluefields, W. Va.	Roadmaster, Norfolk & Western Ry.

S

Schaub, E. L. T., 1885, M. E... Columbus, Ohio.	Draftsman, Jeffrey Mfg. Co.
Schaup, Charles E., 1897, E.M. Berrysburg, W. Va.	Chief Engineer, Southern Coal & Transportation Co.
Scheibel, Wm. O., 1888, E. M. Columbus, Ohio.	Consulting and Contracting Engineer for Concrete Construction.
Schertz, William A., 1904, E.E.	

Schlafly, Roydon K., 1903, C. E. Columbus, Ohio.	Assistant City Engineer.
Schreiber, George E., 1900, E. E. St. Louis, Mo.	Consulting Electrical Engineer.
Schreiber, John M., 1899, E. E. Cleveland, Ohio.	In Engineering Dept., Cleveland Electric Street Railway.
Schroll, Otto, 1886, C. E. Toledo, Ohio.	Superintendent, Toledo Division, Penn. Lines.
Schubert, C. W., 1903, C. E. Mt. Vernon, Ohio.	Draftsman, Mt. Vernon Bridge Works.
Schwab, Frank W., 1902, B. Sc. (Chem.) Newcomerstown, Ohio.	Chemist, James B. Clow & Sons.
Sedgwick, Edgar C., 1895, E. E. Columbus, Ohio.	Chief Engineer, The Case Mfg. Co.
Senter, Herbert P., 1902, C. E. New Castle, Pa.	Assistant on Engineers' Corps, Pennsylvania Lines.
Serva, Adam A., 1903, E. E. Ft. Wayne, Ind.	Assistant Sales Manager and Assistant Secretary, Ft. Wayne Electric Works.
Sharp, Charles C., 1888, C. E. Gauley Bridge, W. Va.	Mine Superintendent and Consulting Mining Engineer.
Shaw, Lucian, 1904, C. E. W. Lafayette, Ohio.	Manufacturer of Cement Block.
Shepard, Harvey L., 1903, B. Sc. (Chem.) Vena, Ger.	Graduate Student.
Shepherd, C. W., 1900, C. E. Chicago, Illinois.	In North Works, Illinois Steel Co.
Sherman, Chris. E., 1894, C. E. Columbus, Ohio.	Professor of Civil Engineering, Ohio State University.
Sherman, John K., 1901, C. E. Pittsburg, Pa.	Assistant on Engineers' Corps, Southwest System, Pennsylvania Lines, West of Pittsburg.
Sill, Edgar T., 1904, E. E. Pittsburg, Pa.	In Testing Dept., Westinghouse Elec. & Mfg. Co.
Simonton, Mark, 1895, E. E. Columbus, Ohio.	Treasurer and General Manager, Electric Supply & Construction Co.
Singleton, Fred, 1904, M. E. Columbus, Ohio.	With Hocking Valley R. R.
Skinner, C. E., 1890, M. E. Pittsburg, Pa.	Engineer, Electrical Engineering Dept., Westinghouse Elec. & Mfg. Co.
Sloctemyer, Carl F., 1903, E. E. Cincinnati, Ohio.	In Engineering Dept., Cincinnati Traction Co.
Smith, David W., 1899, C. E. Columbus, Ohio.	Engineer, Hocking Valley Ry. Co.
Smith, Harry Ford, 1902, M. E. Lexington, Ohio.	Manager, Electric Light Plant.

Smith, Roy B., 1904, M. E..... Columbus, Ohio.	Apprentice, Pan Handle Shops.
Snider, C. M., 1897, B. Sc...... (Ind. Arts.) Columbus, Ohio.	Mechanical Engineer, The Jeffrey Mfg. Co.
Sosman, Robert B., 1903, B. Sc. (Chem.) Boston, Mass.	Student in Mass. Inst. of Tech.
Sperr, Frederick W., 1883, E. M. Houghton, Mich.	Professor of Civil and Mining Engineering, Michigan College of Mines.
Spitler, Grovey O., 1904, B. Sc. (Chem.) Findlay, Ohio.	
Sprague, C. M., 1899, C. E...... Pittsburg, Pa.	Assistant on Engineers' Corps, P., C., C. & St. L. Ry., Pittsburg Division.
Sproat, Amasa D., 1902, E. M.. San Luis Potosi, Mexico.	Chemist, Campania Metalurgica Mexicana.
Spurrier, John R., 1896, E. E.. Manchester, England.	Foreman, Detail Division, Mechanical Dept., British Westinghouse Elec. & Mfg. Co.
Staley, Marcellus, 1899, E. E.. New York City.	Firm of Staley & Gillespie, Electrical Contractors.
Stanton, Fred. M., 1904, B. Sc. (Chem.) World's Fair Grounds, St. Louis, Mo.	With U. S. Fuel Testing Plant.
Starbuck, Daniel K., 1899 E. E. Schenectady, N. Y.	With General Electric Co.
Stellhorn, Adolf, 1900, A. B.; 1903, C. E. Columbus, Ohio.	Transitman, City Engineer's Office.
Stewart, Alton R., 1904, E. E. Rochester, N. Y.	Engineering Assistant, Rochester Ry. & Light Co.
Stewart, Harford T., 1896, E.E. Columbus, Ohio.	Secretary, Case Mfg. Co.
Stewart, Lee R., 1896, C. E.... Camden, N. J.	Engineer in Charge of Mould Loft, New York Ship Building Co.
Stinebaugh, Isaac L., 1892, C. E. Rockaway, Ohio.	Surveyor and Civil Engineer.
Stocker, James A., 1902, C. E.. Charleston, W. Va.	Assistant Engineer, Kanawha & Michigan Railway.
Stone, Carleton E., 1899, C. E. Pittsburg, Pa.	With the P. & L. E. Ry.
Stone, Thomas W., 1902, M. E. Ft. Wayne, Ind.	Chief Draftsman, Western Gas Construction Co.
Storer, Norman W., 1891, E. E. Pittsburg, Pa.	Head of Industrial Dept., Westinghouse Elec. & Mfg. Co.

Storer, Simon B., 1893, E. E. Syracuse, N. Y.	Engineer and Salesman, Westinghouse Elec. & Mfg. Co.
Stull, Emmett W., 1894, E. E. Cincinnati, Ohio.	Engineer, Railway Dept., Bullock Elec. Mfg. Co.
Stull, Raymond T., 1902, E. M. (Ceramics.) Terra Cotta, Ill.	Chemist, American Terra Cotta & Ceramic Co.

T

Tanner, Edward W., 1902, M. E. Cleveland, Ohio.	Draftsman, The Interstate Eng. Co.
Taylor, Arthur W., 1893, E. M. Cleveland, Ohio.	Chemist, Otis Steel Co., Ltd.
Taylor, William O., 1904, E. E. Columbus, Ohio.	Assistant Electrician, Col., London & Springfield Ry.
Templin, John R., 1903, M. E. Christ Church, New Zealand.	With General Electric Co.
Thomas, Edward, 1904, B. Sc. (Chem.) Copley, Pa.	Cement Inspector.
Thomas, James O., 1897, C. E. Columbus, Ohio.	District Toll Chief, Central U. Telephone Co.
Tomlinson, James R., 1892, C.E.	Died November 17, 1903.
Towne, Robert S., 1879, B. Sc.; 1880, E. M. New York City.	President, Campania Metallurgica Mexicana.
Tufts, Charles H., 1899, E. M. Pittsburg, Pa.	Chief Chemist, Shoenberger Works, Am. Steel & Wire Co.
Turner, Arthur M., 1893, E. E. 726 Farrell Ave., Chicago, Ill.	

U

Urban, Harry M., 1898, C. E. Wheeling, W. Va.	Department Engineer, National Tube Co., Riverside Dept.

V

Van Dyke, C. S., 1902, E. E. Schenectady, N. Y.	In Testing Dept., General Electric Co.
Van Tine, C. H., 1903, M. E. Schenectady, N. Y.	Apprentice Steam Turbine Dept., General Electric Co.
Vandervoort, W. P., 1886, E. M.	
Viets, Willis B., 1886, E.M. Parryville, Carbon Co., Pa.	Chemist, Carbon Iron & Steel Co., Ltd.
Vosskuehler, J. H., 1900, M. E. Madison, Wis.	Instructor in Machine Designing, University of Wisconsin.

W

Wadsworth, F. L. O., 1888, E.M. 1889, B. Sc., M. E. Allegheny, Pa.	Director Allegheny Observatory.
Walker, James M., 1896, C. E.. Gadsden, Ala.	Consulting Engineer.
Ward, Samuel E., 1904, M. E.. Pittsburg, Pa.	With Westinghouse Machine Co.
Ward, Vernon C., 1903, M. E.. Chicago, Ill.	Special Apprentice, North Wks., Illinois Steel Co.
Watt, Sern P., 1886, M. E..... Seattle, Wash.	Draftsman and Instructor, Morgan Bros. Co.
Watters, Burr S., 1904, M. E.. Columbus, Ohio.	Draftsman, Columbus Ry. & Lt. Co.
Webber, Frank M., 1903, E. E. Ft. Wayne, Ind.	In Estimating Dept., Ft. Wayne Electric Works.
Weber, F. Clarence, 1901, B. Sc. (Chem.) Washington, D. C.	With Bureau of Chemistry, U. S. Agricultural Dept.
Weick, C. W., 1898, B. Sc. (Ind. Arts.) New York City.	Instructor in Manual Training, Teachers' College, Columbia University.
Welch, Clark J., 1888, C. E... 11 Broadway, New York City.	Bridge and Structural Engineer.
Welch, Oliver B., 1895, E. E... P. O. Box 1618, Pittsburg, Pa.	Mechanical Engineer.
Wellbaum, Arvy E., 1902, M. E. Springfield, Ohio.	Draftsman, Foos Mfg. Co.
Wilcox, Alva N., 1895, E. E.... Dayton, Ohio.	The Pinneo and Daniels Co.
Wilcox, Carl C., 1903, M. E... Saginaw, Mich.	Mechanical Engineer, Saginaw-Bay City Ry. & Light Co.
Williams, Harry E., 1902, M. E. Omaha, Neb.	Special Apprentice, Union Pacific R. R. Shops.
Williamson, H. D., 1901, B. Sc. (Chem.); M. D., Starling Med. Col., 1904. Columbus, Ohio.	Physician.
Wirthwein, L. P., 1899, C. E...	Died May 1, 1905.
Wise, Albert Joseph, 1898, C. E. Wilson Block, Houston, Tex.	Civil Engineer.
Wolf, Herman H., 1895, C. E.. Washington, D. C.	Lieutenant, U. S. Revenue Cutter Service.
Wyer, Samuel S., 1903, M. E.. Forsythe Ave., Columbus, Ohio.	Consulting Engineer.
Wynne, Francis E., 1902, E. E. Pittsburg, Pa.	With Westinghouse Electric & Manufacturing Co.

Y

Yost, Lloyd, 1902, M. E...... Cudahy, Wis.	With The Power & Mining Co.
Youmans, Wm. R., 1903, E. E.. Schenectady, N. Y.	In Testing Dept., General Electric Co.

Z

Zaumseil, Oscar C., 1887, C. E. Webb City, Mo.	Merchant.
Zurfluh, Wm. N., 1894, E. E.. Springfield, Ohio.	Superintendent, Home Lighting, Power and Heating Co.

List of Graduates from Other Colleges of the Ohio State University Who are now doing Engineering Work.

Blinn, Ray S., 1893, B. Sc. Bloomington, Ind.	Acting Division Engineer, Indianapolis Southern R. R.
Bradford, Ernest, 1892, G. Ph. Columbus, Ohio.	Superintendent and Metallurgist, Pioneer Stove Co.
Calkins, Wm. B., 1898, G. Ph. St. Louis, Mo.	Chief Chemist, LaClede Gas Light Co.
Converse, H. P., 1887, B. Sc. Boston, Mass.	Of H. P. Converse & Co., Engineers and Contractors in Iron and Steel.
Evans, Ernest, 1892, B. Sc. Donora, Pa.	Assistant Superintendent, Furnaces Carnegie Steel Co.
Heath, Arthur T., 1887, G. Ph. Oak Harbor, Ohio.	Analytical Chemist, Consulting Engineer and Contractor.
Humphrey, J. S., 1879, B. Sc. Indianapolis, Ind.	Assistant City Civil Engineer.
Jones, Jesse Lee, 1890, B. A. Wilmerding, Pa.	Metallurgist.
Kirker, Harry L., 1889, B. Sc. London, England.	Electrical Engineer, Westinghouse Elec. & Mfg. Co.
Knopf, George W., 1883, B. Sc. Pottstown, Pa.	Engineer, McClintic-Marshall Construction Co.
Lewis, Thomas K., 1894, B. Sc. Columbus, Ohio.	Assistant Professor of Architecture and Drawing, Ohio State University.
Lovejoy, Jesse R., 1884, B. Sc. Schenectady, N. Y.	Manager, Lighting, Railway and Supply Dept., General Electric Co.
McDowell, John A., 1882, B.Sc. Columbus, Ohio.	Chemist, Specialty Portland Cement Manufacture, Mine Examiner.
Mix, Edgar W., 1888, B. Sc. Paris, France.	Chief Engineer, Les Ateliers Thompson-Houston.
Moyer, Henry E., 1893, B. Sc. Youngstown, Ohio.	Chief Chemist, Youngstown Steel Co.
Newton, Harry S., 1889, B. Sc. Warehouse Point, Conn.	General Superintendent, Hartford & Springfield St. Ry. Co.
Phelps, Cyrus A., 1892, B. Sc. Chalchihuites, Mexico.	Treasurer, Cia Minera "Huiriachie," S. A.
Ritchey, Joseph C., 1890, B. Sc. Cleveland, Ohio.	Chemist, American Works, A. S. & W. Co.
Scott, Charles F., 1885, B. A. Pittsburg, Pa.	Consulting Engineer, Westinghouse Electric & Mfg. Co.
Somermeier, E. E., 1898, G. Ph. Columbus, Ohio.	Assistant Professor in Metallurgy, Ohio State University.
Ward, John C., 1880, B. A. Painesville, Ohio.	County Engineer and Surveyor.
Wikoff, John B., 1884, B. Ph. Cleveland, Ohio.	Secretary and Treasurer, Imperial Clay Co., New Lexington, O.

Directory of Those Who have Completed Short Courses

Architecture

Elliott, Emmett F., 1901 Columbus, Ohio.	Draftsman, Richards, McCarty & Bulford, Architects.
Gleichauf, Frank S., 1901 Columbus, Ohio.	Supervising Architect, Richards, McCarty & Bulford, Architects.
Howard, Oscar D., 1902 Columbus, Ohio.	Draftsman, with W. T. Mills, Architect.
Miller, Charles E., 1900 Akron, Ohio.	Master Mechanic, Diamond Rubber Co.

Ceramics

Adams, John Carroll, 1897 Lynchburg, Va.	Manager of Brickyard.
Berkey, Leslie Reese, 1899 Eldorado, Pa.	Manager, Eldorado Brick Co.
Bleininger, Albert V., 1897; 1901, B. Sc. (Chem.) Columbus, Ohio.	Assistant Professor in Ceramics, Ohio State University.
Braddock, Everett F., 1896	
Campbell, Augustine R., 1898 Tottenville, S. I., New York.	Chemist, Atlanta Terra Cotta Co.
Colgan, Frank J., 1901 Grassy Point, N. Y.	With A. M. & W. H. Wiles Co.
Gates, Ellis D., 1901 Chicago, Illinois.	Treasurer American Terra Cotta & Ceramic Co.
Giessen, Carl, 1896 Canton, Ohio.	
Gorton, Elmer Ellsworth, 1896 7 E 42d St., New York City.	
Greaves-Walker, A. F., 1904 Olive Hill, Ky.	With The Olive Hill Fire Brick Co.
Griffin, Carl H., 1903 Worcester, Mass.	Chemist, Norton Emery-Wheel Co.
Hensel, Otto, 1897 New Lexington, Ohio.	With Imperial Clay Co.
Ittner, Warren Wayne, 1899 Bellville, Illinois.	Superintendent, The Anthony Ittner Brick Co.
Jones, Edward J., 1896 Covington, Ky.	Ceramic Chemist, Cambridge Tile Mfg. Co.
Klaus, Frederick J., 1904 Los Angeles, Cal.	With Southern Pacific R. R. Co.
McMillen, Harry, 1904 Nampa, Idaho.	Foreman, Stoneware Pottery.
Morrison, Frank H., 1901 Denver, Col.	President and General Manager, Denver Elec. Porcelain Co.

Porter, Walter J., 1904....... Stockton, Cal.	With Stockton Brick & Pottery Co.
Post, Malcolm Phelps, 1899... St. Louis, Mo.	Foreman, Blackmer-Post Pipe Co.
Purdy, Ross C., 1898.......... Columbus, Ohio.	Student, Ohio State University.
Ogan, Mark, 1904............ St. Louis, Mo.	With St. Louis Terra Cotta Co.
Sandison, Jack Morrison, 1892 Moberly, Mo.	Assistant Manager, Moberly Brick, T. & E. Co.
Singer, Louis Parmelee, 1902.. Lincoln, Cal.	Ceramist, with Gladding, McBean & Co.
Thomas, David C., 1896....... Wellsville, Ohio.	Chemist and Head Burner, U. S. Pottery Co.
Watts, Arthur S., 1901....... New Lexington, Ohio.	Superintendent, High Voltage Porcelain Co.
Wells, Harry B., 1904........ Canandaigua, N. Y.	With Hydraulic Press Brick Co.
Wolfley, John W., 1896...... Mt. Gilead, Ohio.	Supt., Johnson-Wolfley Pottery Co.
Worcester, Wolsey G., 1899.... Columbus, Ohio.	Ceramist.

Industrial Arts

Benbow, James D., 1901....... Columbus, Ohio.	Draftsman, Kilbourne-Jacobs Mfg. Co.
Hoover, Frank G., 1903........ New Berlin, Ohio.	With The W. H. Hoover Co.
Lynn, Harry, 1903............ Columbus, Ohio.	With W. M. Ritter Lumber Co.
Tansey, Howard F., 1903...... Franklin, Warren Co., Ohio.	Farmer.
Umberger, Kyle D., 1903....... Clarksburg, W. Va.	Draftsman and Estimator, Richards Construction Co.

Mining

Anderson, Arthur, 1898.
Athens, Ohio.

Blower, J. W., 1892.
Mine Manager, Trimble, Ohio.

Bohm, Oscar Herman, 1899.
Cleveland, Ohio.

Boyd, Arthur, 1893.
Mine Surveyor, Saginaw, Mich.

Brophy, John S., 1898.
Frostburg, Md.

Carroll, P. H., 1891; 1894, E.M.
Herrin, Illinois.

Dixon, C. F., 1890.

Evans, John M., 1895.

Evans, William, 1902.
Engineer, Superior Coal Co., Wellston, Ohio.

Fitzer, Joseph B., 1903.

Fyfe, John, 1891.

Gildroy, R. E., 1891.

Harrigan, Archer, 1899.
Mining Engineer, K. & H. C. & C. Co., Harewood, W. Va.

HARRIGAN, PATRICK, 1898.
Supt., Congo Coal & Mining Co., Congo, Ohio.

HERRON, J. S., 1893.

JENKINS, JONATHAN, 1891.
Mine Foreman, Lord, Md.

KING, FRANCIS E., 1900.
Asst. Manager, Dominion Coal Co., Glace Bay, C. B., Can.

LAVIERS, HENRY, 1893.
Engineer, Superior Coal Co., Wellston, Ohio.

LAWSON, JOHN F., 1904.
Assistant Engineer, Pittsburg Coal Co., Nelsonville, Ohio.

LOCHRIE, JOHN, 1890.
Gen. Mine Supt., Windber, Pa.

McKAY, R. F., 1894.
Superintendent and Engineer Freeport Smokeless Coal Co.

MOSS, JAMES, 1891.
Supt. and Mining Engineer, Cambridge, Ohio.

NEWTON, E. A., 1893.
Dealer in Knitting Machinery, 245 Case St., Philadelphia, Pa.

NICHOLS, J. L. D., 1895.

OAKES, C. H., JR., 1892.
Manager, Volant, Pa., R. F. D. No. 65.

OGAN, MARK, 1904.
With St. Louis Terra Cotta Co., St. Louis, Mo.

PHILLIPS, F. R., 1893.

QUIGLEY, JOHN, 1893.
Mine Foreman, Snow Shoe, Pa.

QUIGLEY, ROBERT, 1894.
Mine Foreman, Burnside, Pa.

QUINN, JOHN, 1891.
Civil and Mining Engineer, Houtzdale, Pa.

RALSTON, WILLIAM, 1896.
Cleveland, Ohio.

REES, DAVID, 1891.
Asst. Mgr., Empire State, Idaho M. & D. Co., Wardner, Idaho.

REES, EVAN, 1895.
Mining Engineer, The Tom Corwin Coal Co., Wellston, Ohio.

SCHETTLER, BRUNO, 1905.
Mining Engineer, Illinois Collieries Co., Springfield, Ill.

SIDDALL, J. W., 1901.
Mine Engineer, Oliver Iron & Mining Co., Mt. Zion, Minn.

SNEDDEN, JAMES, 1892.

STEWART, ROBERT B., 1903.

TETLOW, W. A., 1892.
Salem, Ohio.

THOMPSON, THOMAS, 1902.
Supt., Wolverine Coal Co., Saginaw, Mich.

WRIGHT, JOHN, 1892.
Mine Foreman, Pottersdale, Pa.

YOUNG, THOMAS B., 1903.
Chemist with N. W. Lord, Columbus, Ohio.

Index

- Admission, 10
  - Modes of 11
  - to Four-Year Courses. Requirements for 16
  - to the Short Courses. Requirements for 22
  - to Special Students 22
- Advanced Standing, Admission to 23
- Amount of Work 28
- Architecture, Course in 30
  - Department work in 52
- Astronomy, Department work in 55

- Ceramics, Course in 32
  - Department work in 56
- Chemical Engineering, Course in 30
- Chemistry, Department work in 59
- Civil Engineering, Course in 36
  - Department work in 61
  - Summer field work in 64
- Clay-Working, Short Course in 49
- College of Engineering, Description of 9
- Correspondence, about admission 15
- Corps of Instruction 5
- Course in Architecture 30
  - Ceramics 32
  - Chemical Engineering 34
  - Civil Engineering 36
  - Electrical Engineering 38
  - Industrial Arts 40
  - Manual Training 42
  - Mechanical Engineering 44
  - Mining Engineering 46
- Course, Short, in Clay-working 49
  - Industrial Arts 50
  - Mining 51

Courses leading to a degree 10
Courses not leading to a degree 48
Courses, First year of Four-year 29
Credit Hour 28

Days and Dates 1
Degrees 10
Drawing, Department work in 65

Economics and Sociology, Department work in........... 68
Education, Department work in 69
Electrical Engineering, Course in 38
    Department work in 70
English, Department work in 73
Enrollment 96
Entrance Condition 21
Entrance, Extent and Character of Subjects for 18
Expenses 24

Fees 24
Fellowship in Engineering, The Stillman W. Robinson 23
First Year in Four-year Courses 29
French, Department work in 74

Geology, Department work in 74
German, Department work in 76
Graduates, Directory of 97
    Number of 97
Gymnasium, Work in 76

History, Department work in 77

Industrial Arts, Course in 40
    Department work in 77
    Short Course in 50
Instruction, Corps of 5

List of accredited and recognized schools 12

Manual Training, Course in 42
Mathematics, Department work in 79
Mechanical Engineering, Course in 44
    Department work in 81
Metallurgy, Department work in 86
Military Drill, Work in 87
Mining Engineering, Course in 46
    Department work in 88
Mining, Short Course in 51

Physics, Department work in 90
Political Science, Department work in 92
Probation 28

Registration 28
Requirements for Admission—
    to Advanced Standing 23
    to Four-Year Courses 16
    to Short Courses 22
    as Special Students 22

Secretary, Hours for Consultation 28
Shop Work, Summer term in 93
    Work in 92
Short Course in Clay-working 49
    Mining 51
    Industrial Arts 50
Spanish, Department work in 95
Special Students 22
Summer Field Work in Civil Engineering 64
Summer Term in Shopwork 93

THE
JOHN CRERAR
LIBRARY

VOLUME X NUMBER 11

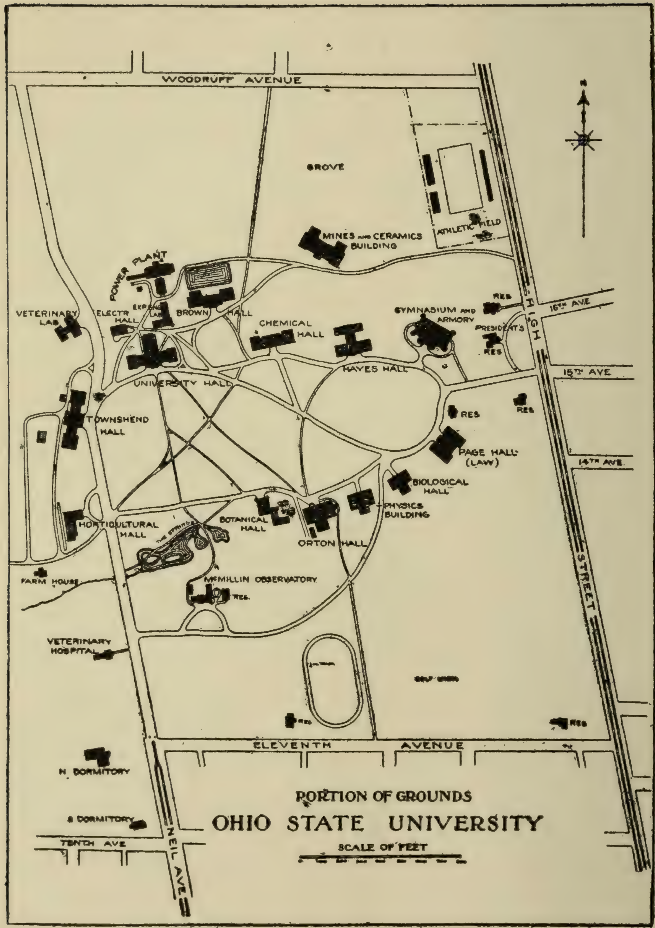
Ohio State University Bulletin

College of Engineering

APRIL 12, 1906

PUBLISHED BY THE UNIVERSITY AT COLUMBUS

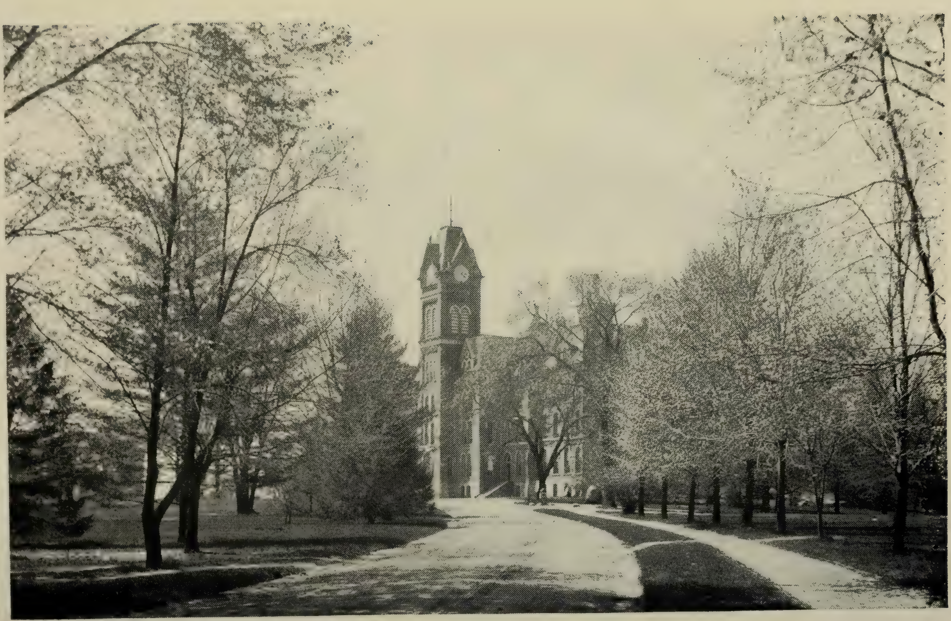
Hy°



PORTION OF GROUNDS

OHIO STATE UNIVERSITY

SCALE OF FEET



UNIVERSITY HALL.

UNIVERSITY CALENDAR

1906.

Entrance examinations, (8 a. m.) Tuesday to Saturday June 12-16.

Summer courses in Surveying, June 15 to July 13.

Summer courses in Shop-Work, June 18 to July 14.

Summer Term, June 25 to August 3.

Entrance examinations, (8 a. m.) Tuesday to Saturday, September 11-15.

First term begins—Registration Day—Tuesday, September 18.

President's Annual Address, (11 a. m.) Friday, September 21.

Latest date of admission to candidacy for a degree at the Commencement of June, 1907, October 1.

Thanksgiving Recess, November 29 and 30, and December 1.

Latest date for filing thesis subjects, Saturday, December 15.

First term ends, December 19.

CHRISTMAS VACATION

1907.

Second term begins—Registration Day—Wednesday, January 2.

Washington's Birthday, Friday, February 22.

Second term ends, Friday, March 29.

SPRING RECESS

Third term begins—Registration Day—Wednesday, April 3.

Field Day—Athletic Association—Saturday, May 11.

Competitive Drill—Cadet Battalion—Saturday, May 25.

Memorial Day, Thursday, May 30.

Final examinations, Friday to Thursday, June 7-13.

Latest date for presenting thesis, Saturday, June 8.

Entrance examinations, (8 a. m.) Tuesday to Saturday, June 11 to 15.

Latest date for filing bound copy of thesis, Friday, June 14.

Commencement, Wednesday, June 19.

OHIO STATE UNIVERSITY

The Ohio State University, located in Columbus two miles north of the Union Station, is a part of the public educational facilities maintained by the State. It comprises six colleges:

The College of Agriculture and Domestic Science,
The College of Arts, Philosophy, and Science,
The College of Engineering,
The College of Law,
The College of Pharmacy,
The College of Veterinary Medicine.

This bulletin of announcements is devoted exclusively to the work of the College of Engineering.

(NOTE: In requesting any of the announcement bulletins of the University, address the Secretary of the University Faculty, Ohio State University, Columbus, Ohio.)

COLLEGE OF ENGINEERING

The purpose of the College of Engineering is to thoroughly ground students in the fundamental sciences and arts upon which all engineering rests; to impart such special and technical knowledge of the various branches of engineering as is practicable in the time available; and finally, by the severe scholastic discipline of this training, together with collateral work in language and literature, to impart an appreciation of the pleasures of culture and scholarship, and a recognition of the civic duties and moral responsibilities which in modern society fall upon every educated man.

In the attainment of these inseparable ends, the work of the College of Engineering is directed, first, to the mastery of the principles of mathematics, physics, and chemistry by means of theoretical courses; second, by laboratory work in these and related sciences and in the graphic arts, to fix principles firmly in the mind of the student and develop his power to apply them to concrete cases; third, to give such opportunity for specialization in the various fields and departments of engineering as its constantly increasing scope and subdivision renders possible. Added to these technical subjects, instruction is given in the use of English, developing the power to write clear and concise reports, and in at least one foreign language sufficient to bring the technical literature of that language within grasp.

It is recognized that the graduate of any engineering school can have at best but a meagre equipment in the actual knowledge of engineering, and that he must inevitably be largely lacking in the experience and mature judgment which the competent engineer brings to his work. But he can at least gain at school a good foundation for accurate reasoning and sound judgment, and it is believed that these qualities are developed in higher degree by such carefully prescribed courses as are here offered, than in partially or wholly elective courses.

The great expansion in technical education witnessed in the last two decades has been due to two causes, first, the rapid growth of the manufacturing industries and of the great public works by which their products are distributed, and second, by the constantly increasing conviction in the minds of manufacturers and administrators that the capable, self-reliant and trustworthy men whom they need are produced in fuller degree by the rigid training of an engineering school than by any other means.

COURSES OFFERED

This college offers instruction in nine important fields of engineering work. Covering these the following four-year courses of study are offered:

1. Architecture, leading to the degree of Civil Engineer in Architecture (C. E. in Arch.).
2. Ceramics, leading to the degree of Engineer of Mines in Ceramics (E. M. in Cer.).
3. Chemical Engineering, leading to the degree of Bachelor of Science in Chemical Engineering (B. Sc.).
4. Civil Engineering, leading to the degree of Civil Engineer (C. E.).
5. Electrical Engineering, leading to the degree of Mechanical Engineer in Electrical Engineering (M. E. in E. E.).
6. Industrial Arts, leading to the degree of Bachelor of Science in Industrial Arts (B. Sc.).
7. Manual Training, leading to the degree of Bachelor of Science in Industrial Arts (B. Sc.).
8. Mechanical Engineering, leading to the degree of Mechanical Engineer (M. E.).
9. Mine Engineering, leading to the degree of Engineer of Mines (E. M.).

The following two-year, or short courses, do not lead to a degree, but students completing them are furnished a formal certificate stating the work they have accomplished:

10. Clay-working.

11. Industrial Arts and Shopwork.
12. Mining.

The necessary instruction for these courses of study is given in twenty-one different departments under eighty-eight professors and assistants. In some of these courses there is opportunity for elective work, which may be selected from any of the forty departments of the University. The library of about 62,000 volumes includes the most important treatises in the different fields of engineering.

FACULTY AND INSTRUCTORS

WILLIAM OXLEY THOMPSON, D. D., LL. D., PRESIDENT OF THE UNIVERSITY.

EDWARD ORTON, JR., E. M., DEAN, Professor and Director of the Department of Clayworking and Ceramics.

SIDNEY AUGUSTUS NORTON, Ph. D., LL. D., Emeritus Professor and Lecturer in General Chemistry.

STILLMAN W. ROBINSON, C. E., D. Sc., Emeritus Professor of Mechanical Engineering.

NATHANIEL WRIGHT LORD, E. M., Professor of Metallurgy and Mineralogy and Director of the School of Mines.

BENJAMIN FRANKLIN THOMAS, Ph. D., Professor of Physics.

GEORGE WELLS KNIGHT, Ph. D., Professor of American History and Political Science.

ROSSER DANIEL BOHANNAN, B. Sc., C. E., E. M., Professor of Mathematics.

BENJAMIN LESTER BOWEN, Ph. D., Professor of Romance Languages and Literatures.

JOSEPH VILLIERS DENNEY, B. A., Professor of English.

WILLIAM THOMAS MAGRUDER, M. E., Professor of Mechanical Engineering.

WILLIAM MCPHERSON, JR., D. Sc., Ph. D., Professor of Chemistry.

JOSEPH NELSON BRADFORD, M. E., Professor of Architecture and Drawing.

HENRY CURWEN LORD, B. Sc., F. R. A. S., Professor of Astronomy and Director of the Emerson McMillin Observatory.

FRANK EDWIN SANBORN, S. B., SECRETARY, Professor and Director of the Department of Industrial Arts.

FRANK ARNOLD RAY, E. M., Professor of Mine Engineering.

GEORGE L. CONVERSE, Captain U. S. A. (Retired), Professor of Military Science and Tactics.

EMBURY ASBURY HITCHCOCK, M. E., Professor of Experimental Engineering.

FRANCIS CARY CALDWELL, B. A., M. E., Professor of Electrical Engineering.

CHARLES SMITH PROSSER, M. S., Professor of Geology.

JOHN ADAMS BOWNOCKER, D. Sc., Professor of Inorganic Geology and Curator of the Museum.

ALFRED DODGE COLE, A. M., Professor of Physics.

CHRISTOPHER ELIAS SHERMAN, C. E., Professor of Civil Engineering.

*ALBERT HENRY HELLER, C. E., Professor of Structural Engineering.

LEWIS ADDISON RHOADES, Ph. D., Professor of Geramic Languages and Literatures.

DAVID R. MAJOR, Ph. D., Professor of Education.

JAMES EDWARD HAGERTY, Ph. D., Professor of Economics and Sociology.

FRANK HARVEY ENO, B. Sc., C. E., Professor of Municipal Engineering.

OLIVE JONES, B. A., Librarian.

GEORGE WASHINGTON MCCORD, M. A., Associate Professor of Mathematics.

WILLIAM EDWARDS HENDERSON, Ph. D., Associate Professor of Chemistry.

---

* Died February 20, 1906.

JAMES ELLSWORTH BOYD, M. S., Associate Professor of Mathematics.

CHARLES A. BRUCE, B. A., Associate Professor of the Romance Languages and Literatures.

THOMAS EWING FRENCH, M. E., Associate Professor of Architecture and Drawing.

CHARLES WILLIAM FOULK, B. A., Associate Professor of Chemistry.

G. A. ANDEREGG, A. M., Associate Professor of Electrical Engineering.

MATTHEW BROWN HAMMOND, Ph. D., Associate Professor of Economics and Sociology.

CLYDE T. MORRIS, C. E., Associate Professor of Civil Engineering.

WILLIAM LUCIUS GRAVES, M. A., Assistant Professor of English.

CHARLES LINCOLN ARNOLD, M. Sc., Assistant Professor of Mathematics.

KARL DALE SWARTZEL, B. Sc., Assistant Professor of Mathematics.

GEORGE H. MCKNIGHT, Ph. D., Assistant Professor of English.

WILLIAM ABNER KNIGHT, M. E., Assistant Professor of Machine-Shop Practice.

HARRY WALDO KUHN, Ph. D., Assistant Professor of Mathematics.

FREDERICK EDWARD KESTER, Ph. D., Assistant Professor of Physics.

ALONZO HULBERT TUTTLE, A. M., Assistant Professor of American History and Political Science.

HORACE JUDD, M. E., M. Sc., Assistant Professor of Experimental Engineering.

EDWIN F. CODDINGTON, Ph. D., Assistant Professor of Mathematics.

EDGAR S. INGRAHAM, Ph. D., Assistant Professor of Romance Languages.

ROBERT F. EARHART, Ph. D., Assistant Professor of Physics.

GEORGE B. VILES, Ph. D., Assistant Professor of Germanic Languages and Literatures.

THOMAS KENYON LEWIS, B. Sc., Assistant Professor of Architecture and Drawing.

ALLAN COGGESHALL, E. E., Assistant Professor of Electrical Engineering.

HENRY RUSSELL SPENCER, Ph. D., Assistant Professor of American History and Political Science.

ALBERT VICTOR BLEININGER, B. Sc., Assistant Professor of Clay-Working and Ceramics.

EDWARD EVERETT SOMMERMEIER. G. Ph., Assistant Professor of Metallurgy and Mineralogy.

WILLIAM LLOYD EVANS, Ph. D., Assistant Professor of Chemistry.

F. A. McKENZIE, Ph. D., Assistant Professor of Economics and Sociology.

CARSON, SAMUEL DUNCAN, M. S., Assistant Professor of English.

ROY STEVENSON KING, M. E., Assistant Professor of Mechanical Engineering.

GEORGE D. HUBBARD, Ph. D., Assistant Professor of Geology.

ROY K. SCHLAFLY, C. E., Assistant Professor of Civil Engineering.

CHARLES C. MAJOR, M. E., Assistant Professor of Architecture and Drawing.

WILLIAM HENRY RENCK, Instructor in Pattern-Making and Founding.

CHARLES PHILIP CROWE, Instructor in Forging.

SILAS MARTIN, Instructor in Drawing.

BERTHOLD AUGUST EISENLOHR, M. A., Instructor in German.

SAMUEL EUGENE RASOR, B. Sc., Instructor in Mathematics.

DON CARLOS HUDDLESON, G. Ph., Instructor in Physical Education for Men.

JOHN SATTERLEE TIDBALL, B. S., Instructor in Drawing.

KATHERINE EMILY ANDREWS, M. A., Instructor in Chemistry.

RALPH ROGERS, Instructor in Architecture and Drawing.

MAY THOMAS, Ph. D., Instructor in German.

MARY E. HASKELL, M. A., Instructor in Romance Languages.

ROBERT MEIKELJOHN, M. E., Instructor in Architecture and Drawing.

J. WARREN SMITH, M. Sc., Lecturer on Meteorology.

BENJAMIN FRANKLIN MAAG, M. Sc., Assistant in Astronomy.

CLARENCE CHARLES VOGT, A. B., Assistant in Civil Engineering.

FRANK C. RIDDLE, Assistant in Clay-Working and Ceramics.

JOHN ROSS CHAMBERLIN, Assistant in Civil Engineering.

KENNETH BAKER WARD, C. E., Assistant in Civil Engineering.

LLOYD CLARK HOPKINS, M. E., Assistant in Mechanical Engineering.

J. A. WILKINSON, B. Sc., Assistant in Chemistry.

JOHN MCBRIDE KNOTE, A. B., Assistant in Chemistry.

F. C. MCKINNEY, M. A., Assistant in English.

J. W. CLAWSON, M. A., Assistant in Physics.

H. G. HEIL, Ph. B., Assistant in Physics.

FELLOWS

CARL RIGDON, M. E., Experimental Engineering.

ADMISSION

Applicants for admission must be at least 17 years of age. Each must be provided with credentials of scholarship from his last instructor or from the last institution with which he has been connected, and with a certificate of good moral character.

There are two modes of admission to the University, (1) by examination and (2) by certificate.

ENTRANCE BOARD

The admission of students to the colleges of the Ohio State University is in the hands of the Entrance Board, who conduct examinations, receive and pass upon certificates and give all necessary information to applicants. After passing upon the credentials of the applicant for admission, or giving him the necessary examinations, the Board will give the applicant an entrance card, showing the number and nature of the credits allowed, and this card will be good toward entrance, up to the face value of the number of units granted.

Advanced Standing.—Applicants who have successfully completed at least one year's work in an approved college, and who bring explicit and official certificates describing their course of study and scholarship, and also certificates of honorable dismissal, will be admitted without examination and without entrance conditions. All correspondence should be addressed to the Entrance Board, Ohio State University, Columbus.

ENTRANCE EXAMINATIONS

Entrance examinations will be held June 12 to 16, and September 11 to 15, 1906. A part of the examinations may be taken in June and the remainder in September. All applicants for admission who are not graduates of accredited or recognized schools must take examinations for admission.

SCHEDULE.—Examinations will be from 8 to 12 a. m. and from 1 to 5 p. m.

Tuesday.

A. M.—Greek and Roman History, English History, General History.

P. M.—Composition, Rhetoric and Classics, Chemistry, Geology.

Wednesday.

A. M.—Algebra, German, English Grammar, Descriptive Geography.

P. M.—Plane Geometry, Physical Geography, Arithmetic.

Thursday.

A. M.—Civics, Solid Geometry, Zoology.

P. M.—Beginning Latin, Cæsar, Astronomy.

Friday.

A. M.—Physics, Physiology, Botany.

P. M.—U. S. History, French, English Literature.

Saturday.

A. M.—Vergil, Cicero.

CERTIFICATES

Applicants may be admitted on presentation of properly indorsed certificates from secondary schools which have been "accredited" or "recognized" by the University.

Accredited schools are those four-year secondary schools whose courses of study have been found by inspection to teach satisfactorily such branches of study as prepare students for all colleges of the University. All graduates holding certificates from this class of schools will be admitted without examination, provided the required entrance branches are covered in the certificates.

Recognized schools are those three or four-year secondary schools whose courses of study do not prepare students for all colleges of the University, but have been found by inspection to teach satisfactorily not less than 10 units of the requirements for admission. Any graduate holding a certificate from one of these schools will be admitted without examination to any college of the University for which he is prepared.

A certificate from a recognized school, when it is presented by a graduate thereof, will be accepted toward admission; but an applicant holding such a certificate will be subject to examination in the requirements for admission not covered by the certificate.

No applicant will be admitted by certificate who is not a graduate of the school from which he bears a certificate.

LIST OF ACCREDITED AND RECOGNIZED SCHOOLS IN OHIO

These lists are subject to change from year to year as schools are revisited. Persons are advised therefore to consult the latest bulletins and catalogues of the University.

Alliance R.
Akron A.
Andover R.
Ashland A.
Ashtabula A.
Ashville R.
Athens R.
Baltimore R.
Barnesville A.
Batavia R.
Bedford R.
Bellaire R.
Bellefontaine A.
Bellevue R.
Bethel Township, Clark Co. R.
Bethel Township, Miami Co. R.
Bowling Green A.
Bryan A.
Bucyrus A.
Caldwell R.
Cambridge A.
Canal Dover R.
Canal Winchester R.
Canton A.

Carey R.
Celina R.
Chagrin Falls R.
Chardon A.
Chillicothe A.
Cincinnati—
  Hughes A.
  Walnut Hills A.
  Woodward A.
Cincinnati Technical School A.
Circleville A.
Cleveland—
  Central A.
  East A.
  Lincoln A.
  West A.
  South A.
  Glenville A.
Clintonville R.
Clyde A.
Collinwood A.
Columbus—
  Central A.
  East A.
  North A.
  South A.
Columbus School for Girls A.
Columbus Grove R.
Conneaut R.
Corning R.
Coshocton A.
Covington R.
Cumberland R.
Cuyahoga Falls R.
Dayton A.
Defiance R.
Delaware A.
Delta R.
DeGraff R.
Dennison R.
East Cleveland A.
East Liverpool A.
Elyria A.
Euclid R.
Findlay A.
Fort Recovery R.
Fostoria A.
Fremont A.
Friends' Boarding School Barnesville R.
Galion A.
Gallipolis A.
Garrettsville. R.
Georgetown A.
Germantown R.
Glendale A.
Gnadenhutten R.
Grand River Institute A.
Granville R.
Greenfield A.
Greenville A.
Grove City R.
Groveport R.
Hamilton A.
Harmony Township (Clark County) R.
Harrison R.
Hillsboro A.
Ironton A.
Jackson A.
Jefferson A.
Kenton A.
Kingsville A.
Kirtland R.
Lakeside A.
Lakewood A.
Lancaster A.
Lebanon R.
Leipsic R.
Lima A.
Lockland A.
Logan A.

London A.
Lorain R.
Madison R.
Madisonville A.
Mad River Tp. (Enon Vil.) R.
Malta R.
Mansfield A.
Marietta A.
Marion A.
Martins Ferry A.
Marysville A.
Massillon R.
Medina A.
Mechanicsburg A.
Miamisburg A.
Middletown A.
Mt. Sterling R.
Mt. Vernon A.
Napoleon R.
Nelsonville A.
Newark A.
New Bremen R.
New Lexington R.
New London A.
New Lyme Institute A.
New Philadelphia A.
New Vienna R.
Niles R.
North Baltimore R.
Norwalk A.
Norwood R.
Oak Harbor R.
Oberlin A.
Oberlin Academy A.
Orrville R.
Osborne R.
Ottawa R.
O. S. & S. O. Home R.
Painesville A.
Pandora R.
Pataskala R.
Perrysburg R.
Piqua A.
Plain City R.
Pleasant Ridge R.
Pomeroy R.
Port Clinton R.
Portsmouth A.
Quaker City R.
Ravenna R.
Reynoldsburg R.
Richwood R.
Ripley R.
Salem A.
Salineville R.
Sandusky A.
Shelby R.
Sidney A.
Solon R.
Somerset R.
South Charleston R.
Spencerville R.
Springfield A.
Steubenville A.
St. Marys A.
St. Paris R.
Tiffin A.
Tippecanoe City R.
Toledo A
Troy A.
Uhrichsville R.
Urbana A.
Upper Sandusky R.
Utica R.
Van Wert A.
Wapakoneta R.
Warren A.
Washington C. H. A.
Wauseon R.
Wellington A.
Wellston A.
Wellsville A.

West Jefferson R.
West Milton R.
West Unity R.
Willoughby A.
Woodsfield R.
Wooster A.
Worthington R.
Wyoming A.
Xenia A.
Youngstown A.
Zanesville A.

ACCREDITED SCHOOLS OF OTHER STATES

Michigan—Albion; Ann Arbor; Alpena; Adrian, Benton Harbor Collegiate Institute; Battle Creek; Bay City; Charlotte; Bessemer; Calumet; Coldwater; Detroit—Western, Eastern, Central, Home and Day, Detroit University; Delray; Escanaba; Ferris Institute; Flint; Grand Rapids Central; Hancock; Ionia; Ishpeming; Iron Mountain; Jackson; Kalamazoo; Lansing; Lake Linden; Ludington; Marshall; Manistee; Menominee; Michigan Seminary (Kalamazoo); Muskegon; Michigan Military Academy (Orchard Lake); Mt. Clemens; Marquette; Negaunee; Owosso; Port Huron; Niles; Pontiac; Petoskey; Sault Ste. Marie; Saginaw—West Side, East Side; St. Joseph; Traverse City; West Bay City; Ypsilanti.

Indiana—Elkhart City; Fort Wayne; Howe Military School; LaPorte; Michigan City; Richmond; South Bend; Shortridge and Manual Training, Indianapolis.

Illinois—Aurora (East); Aurora (West); Bloomington; Chicago—Austin, Calumet, Englewood, Hyde Park, Jefferson, John Marshall, Joseph Medill, Lake, Lake View, North West Division, Richard T. Crane, Manual Training, Robert A. Waller, South Chicago, Wendell Phillips, William McKinley; Decatur; De Kalb Tp.; Dixon; Elgin; Evanston Tp.; J. Sterling Morton Tp.; Joliet Tp.; La Salle, Peru Tp.; Lyons Tp. (La Grange); Moline; Oak Park Tp.; Ottawa Tp.; Peoria; Pontiac Tp.; Princeton; Rockford; Rock Island; Sterling Tp.; Thornton Tp. (Harvey).

Iowa—Boone; Burlington; Capital Park; Cedar Rapids; Charles City; Clinton; Corning; Council Bluffs; Davenport; Des Moines—East, North, West; Fort Dodge; Grinnell; Iowa City; Le Mars; Mason City; Muscatine; Ottumwa; Sheldon; Sioux City.

Wisconsin—Appleton; Ashland; Baraboo; Wayland Academy at Beaver Dam; Beloit; Berlin; Chippewa Falls; Eau Clair; Fond du Lac; Grand Rapids; Janesville; La Crosse; Madison; Marinette; Marshfield; Menomonee; Milwaukee—East Division, West Division, South Division, Milwaukee Downer Seminary; New Richmond; Oshkosh; Portage; Racine; Ripon; Sheboygan; Sparta; Stevens Point; Superior—Blaine, Dewey; Waukesha; Whitewater.

MINNESOTA—Duluth; Minneapolis—Central, East Side, North Side, South Side; Redwing; St. Paul—Central, Cleveland, Humboldt; Winona.

MISSOURI—Columbia; Kansas City Central, Kansas City Manual Training; Trenton; St. Louis—McKinley, St. Louis Central.

COLORADO—Canon City; Cripple Creek; Denver, West Side; Durango; Ft. Collins; Golden; Grand Junction; Greeley; La Junta; Leadville; Pueblo, Central; Pueblo, District No. 1; Trinidad; Victor.

SOUTH DAKOTA—Yankton.

Certificates will not be accepted for admission from High Schools that are not named in the above lists.

Certificates from "accredited" and "recognized" schools will be accepted in lieu of examination only under the following conditions:

(a) The certificate must state in detail the studies pursued, the text-books used, the amount of work done in each study, the amount of time devoted to it, and the fact that the applicant has successfully passed in the work.

(b) The certificate will be accepted for such studies only, or such part of each, as it shall show to have been satisfactorily accomplished.

(c) Every such certificate must be accompanied with a diploma or must show that the candidate has been graduated from the school from which he comes. Blank certificates may be obtained by addressing the Secretary of the Entrance Board. Certificates should be filled out and returned to the University as early as possible after the close of the schools in June, and in any event not later than September 8.

REQUIREMENTS FOR ADMISSION TO THE FOUR-YEAR COURSES FOR THE YEAR 1906-'07

Applicants to be admitted to full standing must obtain credit by examination or certificate for thirteen units* chosen from the five groups which follow, subject to the restrictions stated therein.

A—ENGLISH GROUP

Two units chosen from the following:

English Composition and Rhetoric	1 unit
English Classics	1 unit
English Literature	1 unit

B—HISTORY GROUP

Two units chosen from the following:

Civil Government	½ unit
United States History	½ unit
General History	½ unit or 1 unit
Greek and Roman History	½ unit or 1 unit
English History	½ unit

C—MATHEMATICS GROUP

Three units as follows. No conditions are permitted in Mathematics:

Algebra (through quadratics)	1 unit
Algebra (beyond quadratics)	½ unit
Geometry (plane)	1 unit
Geometry (solid and spherical)	½ unit

---

*A unit course of study is a course covering a school year of not less than thirty-five weeks with four or five periods of at least forty-five minutes each per week.

D—SCIENCE GROUP

Two units chosen from the following, including Physics:

Physics	1 unit
Physical Geography	½ unit
Botany	½ unit
Chemistry	1 unit
Physiology	½ unit
Zoology	½ unit
Geology	½ unit
Astronomy	½ unit

E—FOREIGN LANGUAGE GROUP

Four units chosen from the following, or two units from this group, together with two extra units from Groups A, B and D.

Latin	1 to 4 units
Greek	1 to 4 units
German	1 to 4 units
French	1 to 4 units
Spanish	1 to 4 units

A modern language is preferred, but Latin and Greek will be accepted. Those entering college with Latin or Greek will be required to begin a modern language in the first year of their course. Those entering with a modern language will be required to continue the same language in their first year.

ENTRANCE CONDITIONS

No applicant under twenty-one years of age will be admitted to the four-year courses of the College of Engineering who is in arrears more than one unit in entrance requirements; i. e., he must have twelve out of the thirteen units required.

An applicant twenty-one years of age or over who is deficient in foreign language training will be admitted with this deficiency in addition to the one unit permitted above; i. e., he may enter with a minimum of ten out of the thirteen units required.

REQUIREMENTS FOR ADMISSION TO THE FOUR-YEAR COURSES FOR THE YEAR 1907-'08

Applicants to be admitted to full standing must obtain credit for fifteen units instead of thirteen as required in 1906-'07.

Groups A, B, C, and D: Requirements remain unchanged. An applicant who is in arrears one unit in any one of these groups will be admitted conditionally if his arrearage in all of the groups does not exceed three units.

E. Foreign Language Group. Six units from this group, or, four units from this group together with two extra units from groups A, B, and D are required for unconditional admission. An applicant who is in arrears two units will be admitted conditionally if his arrearage in all of the groups does not exceed three units.

Latin	2 to 4 units.
Greek	2 to 4 units.
German	2 to 4 units.
French	2 to 4 units.
Spanish	2 to 4 units.

Applicants who have had not less than two years of technical experience acceptable to the executive committee may have such experience substituted for not more than two units of the entrance requirements in foreign languages.

REMOVAL OF ENTRANCE CONDITIONS

All entrance conditions must be removed by examination under University officers before the beginning of the third year, except that Physics must be removed before the beginning of the second year. Certificates will not be received for entrance conditions after matriculation.

For those who have conditions in foreign language to remove, the following special arrangements will be made:

1. Those entering with a partial credit in Latin or Greek may make good their deficiency by doing an equivalent amount of work in a modern language in the college. For this work they will receive no college credit.

2. Those twenty-one years of age or over, entering with no training in language, may make good their deficiency by beginning a modern language in the college. For this work they will receive no college credit.

DESCRIPTION OF SUBJECTS ACCEPTED FOR ADMISSION

A—THE ENGLISH GROUP

ENGLISH COMPOSITION AND RHETORIC. One unit. Each applicant must be able to write clear and correct English, and no applicant will be accepted in English whose work is seriously defective in spelling, punctuation, grammar, and paragraph structure. The proper preparation for this part of the requirement is practice in composition through the four preparatory years, with correction of themes by the teacher and revision by the pupil. Subjects for themes should be taken from the books prescribed for general reading below and also from the pupil's observation and experience. Practice should be afforded in writing narrative, description, exposition, and argumentation. Applicants should be familiar with those principles of Rhetoric which are most helpful in elementary composition; viz., the principles of sentence structure, outlining, paragraphing, and choice of words. The amount and kind of work required is indicated in Scott and Denney's Elementary Composition and Composition-Literature.

ENGLISH CLASSICS. One unit. (a) A thorough knowledge of the subject-matter, form, and structure of Shakespere's Macbeth, Milton's Lycidas, Comus, L'Allegro, Il Penseroso; Burke's Speech on Conciliation with America (or Washington's Farewell Address and Webster's First Bunker Hill Oration); Macaulay's Life of Johnson (or Carlyle's Essay on Burns). (b) A general knowledge of the substance of ten books selected from the following groups: Group 1 (two to be selected), Shakespere's As You Like It, Julius Cæsar, Merchant of Venice, Twelfth Night, Henry the Fifth; Group

2 (one to be selected), Bunyan's Pilgrim's Progress, part 1; Bacon's Essays, The Sir Roger de Coverley Papers in the Spectator, Franklin's Autobiography; Group 3 (one to be selected), Chaucer's Prologue, selections from Spenser's Faerie Queene, Pope's Rape of the Lock, Goldsmith's Deserted Village, Palgrave's Golden Treasury, first series, books ii and iii, with especial attention to Dryden, Collins, Gray, Cowper and Burns; Group 4 (two to be selected), Hawthorne's House of the Seven Gables, Thackeray's Henry Esmond, George Eliot's Silas Marner, Dickens' A Tale of Two Cities, Scott's Ivanhoe, Quentin Durward, Goldsmith's Vicar of Wakefield, Mrs. Gaskell's Cranford, Blackmore's Lorna Doone; Group 5 (two to be selected), Emerson's Essays (selected), Ruskin's Sesame and Lilies, Irving's Sketch Book, Carlyle's Heroes and Hero Worship, DeQuincey's Joan of Arc and the English Mail Coach, Lamb's Essays of Elia; Group 6 (two to be selected), Palgrave's Golden Treasury, first series, book iv., with especial attention to Wordsworth, Keats and Shelley, Coleridge's Ancient Mariner, Lowell's Vision of Sir Launfal, Scott's Lady of the Lake, Poe's Poems, Tennyson's Gareth and Lynette, Lancelot and Elaine, The Passing of Arthur, Arnold's Sohrab and Rostum, Byron's Mazeppa, The Prisoner of Chillon, Macaulay's Lays of Ancient Rome, and Browning's Cavalier Tunes, Lost Leader, How They Brought the Good News, Evelyn Hope, Home Thoughts from Abroad, Home Thoughts from the Sea, Incident of the French Camp, The Boy and the Angel, One Word More, Herve Riel, Pheidippides.

ENGLISH LITERATURE. One unit. A good knowledge of the leading facts in the history of English Literature, as given in Scudder's English Literature, Johnson's History of English and American Literature or the Introductions by Pancoast, Painter, Halleck, or Newcomer; together with the reading of representative works of literature. This may be offered in lieu of subject (2).

B—HISTORY GROUP

CIVIL GOVERNMENT. One-half unit. A good knowledge of the origin, principles, forms and powers of the national, state, and local governments is expected. Fiske's Civil Government, with a special study of the state from which the student comes, may serve to indicate the amount and kind of knowledge sought.

UNITED STATES HISTORY. One-half unit. A good knowledge of the main facts and features of American History, especially of the period since 1750, is expected. Johnson's High School History of the United States, or McLaughlin's History of the American Nation, or Montgomery's Student's American History will serve to show the kind and amount of work sought. No credit upon certificate will be accorded in this subject for work done below the ninth grade.

GENERAL HISTORY. One unit, or one-half unit. Adams' European History, Munro and Whitcomb's Mediæval and Modern History, or an equivalent.

GREEK AND ROMAN HISTORY. One-half unit or one unit. Botsford's Ancient History for Beginners, West's Ancient World, Wolfson's Essentials in Ancient History, or equivalents.

ENGLISH HISTORY. One-half unit. Andrews' History of England, Cheyney's Short History of England, or equivalent.

C—MATHEMATICS GROUP

ALGEBRA. One unit. Taylor's Elements of Algebra, or an equivalent. Special attention should be given to the four fundamental operations (single and system), factoring, highest common factor, lowest common multiple, fractions and fractional equations, involution, evolution, surds, complex quantities, quadratic equations solved by factoring, by completing the square and the general formula.

ALGEBRA. One-half unit. A thorough review of the work above named, irrational equations, simultaneous quadratic equations, higher equations solvable by factoring, ratio, proportion, progressions, theory of exponents, binominal theorem for positive integral exponents and use of five-place tables of logarithms. It is recommended that this work be taken in the last year of the high school course.

GEOMETRY. One unit. Venable, White, Wells, Wentworth, Beman and Smith, or an equivalent. Plane geometry with solution of originals.

GEOMETRY. One-half unit. Solid and spherical geometry, with solution of originals given in the text-books named above.

D—SCIENCE GROUP

PHYSICS. One unit. Carhart and Chute's Elements, Gage's Elements, Avery's Elements. Laboratory training, to accompany the work of the text-book, is strongly recommended.

PHYSICAL GEOGRAPHY. One-half unit. Tarr's Davis' or Gilbert and Brigham's Physical Geography.

BOTANY. One-half unit. Kellerman's Elementary Botany and Spring Flora, or an equivalent. The course should be divided between spring and fall.

CHEMISTRY. One unit. Remsen's introduction to the Study of Chemistry, or its equivalent. For laboratory work, McPherson's Laboratory Exercises, arranged to accompany Remsen's Chemistry. The course should consist of at least three recitations and four hours of laboratory work weekly. No credit in chemistry will be allowed for preparatory work less thorough than that outlined above.

PHYSIOLOGY. One-half unit. Martin's Human Body (brief course). No credit will be accorded in this subject for work done below the ninth grade.

ZOOLOGY. One-half unit. Jordan, Kellogg and Heath's Animal Studies; Kellogg's "Elementary Zoology"; Davenport's "Introduction"; or equivalents, with laboratory or field work.

GEOLOGY. One-half unit. Brigham's, Dana and Rice's (revised), Tarr's, or LeConte's may be used as texts. The recitations should be supplemented by study of the geological phenomena and formations found in the vicinity of the school.

ASTRONOMY. One-half unit. Young's Lessons, Comstock's, or equivalent.

E—FOREIGN LANGUAGE GROUP

LATIN. First unit. Pronunciation (Roman method); Grammar (an exact knowledge of the inflections). Second unit. Cæsar, the first four books of the De Bello Gallico. Third unit. Cicero, six orations of Cicero, including Pro Lege Manilia. Fourth unit. Vergil, the first six books of the Aeneid with Prosody; and Prose Composition, Daniel, or Collar, or Bennett, or Dodge and Tuttle, entire. Latin cannot be continued as a university study unless at least three units are offered for admission.

GREEK. First unit. Grammar (Goodwin's preferred) and Prose Composition; or White's First Greek Book. Second unit. Reading: The first three books of Xenophon's Anabasis. A third unit will be allowed for preparation in the fourth, fifth, and sixth books of the Anabasis and three books of Homer's Iliad, and a fourth unit for additional reading in Greek.

GERMAN. First unit. The pupil should be able to read at sight, and to translate, if called upon, by way of proving his ability to read, a passage of very easy dialogue or narrative prose. help being given upon unusual words and constructions; to put into German short English sentences taken from the language of every-day life or based upon the text given for translation, and to answer questions upon the rudiments of grammar as defined below. During the first year the work should comprise: (1) Careful drill upon pronunciation; (2) the memorizing and frequent repetition of easy colloquial sentences; (3) drill upon the rudiments of grammar, that is, upon the inflection of the articles, of such nouns as belong to the language of every-day life, of adjectives, pronouns, weak verbs, and the more usual strong verbs, also upon the use of the more common prepositions, the simpler uses of the modal auxiliaries, and the elementary rules of syntax and word-order; (4) abundant easy exercises designed not only to fix in mind the forms and principles of grammar, but also to cultivate readiness in the reproduction of natural forms of expression; (5) the reading of from 75 to 100 pages of graduated texts from a reader, with constant practice in translating into German easy variations upon sentences and in the reproduction from memory of sentences previously read. Second unit. During the second year work should comprise: (1) The reading of from 150 to 200 pages of literature in the form of easy stories and plays; (2) accompanying practice, as before, in the translation into German of easy variations upon the matter read, and also in the off-hand reproduction, sometimes orally and sometimes in writing, of the substance of short and easy selected passages; (3) continued drill upon the rudiments of the grammar, directed to the ends of enabling the pupil, first, to use his knowledge with facility in the formation of sentences, and, secondly, to state his knowledge correctly in the technical language of grammar.

Four units. The applicant must offer, in addition to the above, two additional years of instruction in German, including a review of the essentials of grammar. The rapid reading of at least 200 pages of prose; for example, the following: Heyse's L'Arrabbiata, Riehl's Der Fluch der Schoenheit, Hauff's Lichtenstein. The outlines of German Literature should be mastered. In connection with this about 200 pages of German ballads and lyrics should be read. Some book like v. Klenze's Deutsche Gedichte might be used. A considerable portion of the prose and poetry should be read extemporaneously. About 50 pages in some prose composition should be translated. Text-books suggested are: Wesselhoeft's or Harris' Prose Composition. The work in composition should be carried on as far as possible in German.

FRENCH. First unit. Applicants should be able to pronounce French accurately, to read at sight easy French prose, to put into French simple English sentences taken from the language of every-day life or based upon a portion of the French text read, and to answer questions on the rudiments of the grammar as defined below. During the first year the work should comprise: (1) Careful drill in pronunciation; (2) the rudiments of grammar, including the inflection of the regular and the more common irregular verbs, the plural of nouns, the inflection of adjectives, participles, and pronouns; the use of personal pronouns, common adverbs, prepositions, and conjunctions; the order of words in the sentence and the elementary rules of syntax; (3) abundant easy exercises, designed not only to fix in the memory the forms and principles of grammar, but also to cultivate readiness in the reproduction of natural forms of expression; (4) the reading of from 100 to 175 duodecimo pages of graduated texts, with constant practice in translating into French easy variations of the sentences read (the teacher giving the English), and in reproducing from memory sentences previously read; (5) writing French from dictation. Second unit. During the second year the work should comprise: (1) The reading of from 250 to 400 pages of easy modern (nineteenth century) prose in the form of stories, plays or historical or biographical sketches; (2) constant practice, as in the previous year, in translating into French easy variations upon the texts read; (3) frequent abstracts, sometimes oral and sometimes written, of portions of the text already read; (4) writing French from dictation; (5) continued drill upon the rudiments of grammar, with constant application in the construction of sentences; (6) mastery of the forms and use of pronouns, pronominal adjectives, of all but the rare irregular verb forms, and of the simpler uses of the conditional and subjunctive.

Four units. In addition to the above, the applicant should be able to read at sight, with the help of a vocabulary of special or technical expressions, difficult French not earlier than that of the seventeenth century; to write in French a short essay on some simple subject connected with the words read; to put into French a passage of easy English prose and to carry on a simple conversation in French.

SPANISH. Two units. Applicants should be able to pronounce Spanish accurately, to read at sight easy Spanish prose, to put in Spanish simple English sentences taken from the language of every-day life or based upon a portion of the Spanish text read, and to answer questions on the essentials of the grammar. The first year should be spent mainly on the grammar with easy reading and oral practice; the second devoted to reading good modern Spanish, with grammatical analysis and exercises in writing. The texts read should be chiefly narrative and conversational prose, including one or more prose dramas of the present age.

Four units. In addition to the above, the applicant should be able to read at sight, with the help of a vocabulary of special or technical expressions, difficult Spanish, whether prose or poetry; to write in Spanish a short essay on some simple subject connected with the works read, which shall show a thorough knowledge of syntax; to put into Spanish a passage of easy English prose, and to carry on a simple conversation in Spanish.

ADMISSION TO THE SHORT COURSES

Applicants must not be less than seventeen years of age, and, unless they are over twenty-one years of age, must pass examinations in Arithmetic and Geography, and must be able to write a business letter or a short theme, correct in Grammar and Orthography; or they must present satisfactory certificates showing that they have successfully pursued these subjects elsewhere. In addition, each applicant under twenty-one years of age must present a letter or certificate showing that he has had at least one year's practical experience in some industry related to the course which he wishes to pursue.

Applicants over twenty-one years of age are admitted without examination, and without letter or certificate of practical experience.

SPECIAL STUDENTS

Students who desire to pursue special lines of work in the University, and do not desire to become candidates for degrees, will be admitted on the following conditions:

1. The regular entrance requirements must be satisfied.

But applicants who are not less than twenty-one years of age, after obtaining credit for elementary or "grade" work, and for such other subjects as may be necessary to qualify them for the classes that they wish to enter, may, on the presentation of satisfactory reasons, be admitted by the joint action of the Entrance Board and the Executive Committee of the College, to any class in the College; provided, that if any student who has been admitted on these conditions afterwards becomes a candidate for a degree, he shall take the omitted entrance examinations at least two academic years before the degree is conferred.

2. On entering the College, students desiring to pursue special work are required to lay before the Faculty, for approval or modification, a written statement of the end they have in view, the studies proposed for the attainment of that end, and the probable period of attendance. Such students will be held as strictly to their accepted schemes of work as are the regular undergraduates to their courses of study.

3. Permission to enter as special undergraduates will be refused to all who fail to give satisfactory evidence of definiteness of purpose and will be withdrawn whenever the conditions on which it was granted cease to exist.

COURSES OF STUDY

All engineering education is based on the constant use of the fundamental sciences, mathematics, physics, and chemistry, supplemented by training in the art of expression by both language and drawing. It naturally follows that all engineering courses start from a common point, proceed side by side for a time, but specialize and subdivide more and more as they progress toward completion, until in the last year they present but little work in common.

Further, it is very commonly the case with young men entering college for a technical education, that they are following ambitions not founded on any knowledge of their own natural aptitudes or capacities, and that they are in no way prepared to make a wise or final selection of their life work at that time.

For these two reasons the work of the first year is made identical in all of the engineering courses leading to a degree. The student is enrolled as a "First-year Engineer." His selection of the course he wishes to pursue is deferred to the latter part of his first year, by which time he has become acquainted to some extent with University standards and methods, with the scope of the various courses offered, and with his own tastes and powers.

OUTLINE OF THE FIRST YEAR'S WORK OF ALL FOUR-YEAR COURSES

NOTE—The figure in parenthesis following the name of each study indicates the number of the study in its department. A full description of department work follows this statement of Courses.

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Mathematics (31) Algebra.	5.	Mathematics (32) Trigonometry.	5.	Mathematics (33) Analytics.	5.
Chemistry (7) Inorganic.	5.	Chemistry (7) Inorganic.	5.	Chemistry (12) Qualitative Analysis.	4.
Modern Language French, Ger. or Span.	4.	Modern Language French, Ger. or Span.	4.	Modern Language French, Ger. or Span.	4.
English (1) Composition.	2.	English (1) Composition.	2.	English (1) Composition.	2.
Drawing (27) Freehand.	2.	Drawing (25) Freehand.	1.	Drawing (26) Freehand.	1.
		Drawing (31) Geometric.	1.	Drawing (32) Lettering.	2.
Military Drill.		Military Drill, Gymnasium.		Military Drill.	

SUMMER TERM IN SHOPWORK—Students electing courses named below are required in take Shopwork courses in the summer term as follows:

Chemical Engineering—Shopwork (7) and (11), at the close of the first or second year.

Ceramics, Electrical Engineering and Mechanical Engineering—Two from Shopwork (4), (7) and (11), at the close of the first year.

COURSE IN ARCHITECTURE

This course is designed to combine with Architecture as a fine art a thorough training of those phases of engineering which deal with the problems of construction that must be solved before a building can be erected.

Drawing is an important factor in the education of the architect, including that of the artist and of the engineer. The following courses indicate the training in this subject:—freehand drawing from models and plaster casts, brush drawing from cast, still life and out-door sketching, pen drawing, clay modeling, photography, geometric drawing, lettering, mechanical drawing, descriptive geometry, shades and shadows and architectural perspective.

The history of architecture is taught by lectures, reference reading, and recitations, being freely illustrated by a selected set of lantern slides which familiarizes the student with the architecture of the past. Parallal with the history of architecture is a course of drawing which is devoted to the details of the "Orders" of architecture, Romanesque and Renaissance, thereby fixing firmly in mind the characteristics of each.

Decoration and ornament are taught by lectures and practice, consideration being given to the different styles of architecture in both form and color. Closely allied to this is a study of the principles of architectural composition, given by lectures and assigned problems.

Architectural design consists of preparing the necessary drawing, specifications, and estimates, for proposed structures, such as may be encountered in the practice of first-class professional architects.

The engineering and technical training comprises the following: Mathematics, mechanics, strength of materials, stresses in trusses and framed structures, steel skeleton construction and fireproofing for tall buildings, heating and ventilating, sanitary plumbing, masonry, concrete construction, and testing of materials.

FOR OUTLINE OF FIRST YEAR SEE PAGE 29.

SECOND YEAR

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours.	THIRD TERM.	Credit hours.
Drawing (33) Projections.	3.	Drawing (36) Descriptive Geom.	5.	Drawing (37) Shades, Shadows.	5.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Architecture (9) His. of Architecture.	3.	Architecture (10) His. of Architecture.	3.	Architecture (11) His. of Architecture.	3.
Architecture (12) Detail Drawing.	2.	Architecture (13) Detail Drawing.	2.	Architecture (14) Detail Drawing.	2.
Drawing (14) Pen Drawing.	2.				
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

THIRD YEAR

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours.	THIRD TERM.	Credit hours.
Mathematics (71) Statics.	5.	Mathematics (72) Strength Mat'ls, Kinet.	5.	Architecture (24) Framing Details.	2.
Architecture (22) Arch. Composition.	2.	Architecture (23) Designing.	4.	Architecture (17) Designing.	4.
Drawing (7) Photography.	2.	Drawing (40) Clay Modeling.	2.	Drawing (41) Clay Modeling.	2.
Architecture (15) Designing.	4.	Drawing (18) Water Color Paint'g	2.	Drawing (19) Water Color Paint'g.	3.
Architecture (5) Decorations, etc.	3.	Civil Eng.. (6) Stereotomy.	4.	Civil Eng. (19) Trusses.	5.
English (2) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.

FOURTH YEAR

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours.	THIRD TERM.	Credit hours.
Architecture (18) Designing.	4.	Architecture (4) Specifications.	2.	Architecture (6) Estimates and Supt.	4.
Civil Eng. (15) Masonry.	5.	Architecture (25) Plumbing.	2.	Architecture (19) Designing.	4.
Mech. Eng. (23) Materials of Const.	4.	Architecture (21) Designing.	2.	Architecture (20) Thesis.	5.
Geology (2) General.	5.	Civil Eng. (28) Steel Construction.	5.	Civil Eng. (21) Surveying.	3.
		Civil Eng. (29) Cement Testing.	3.		
		Mech. Eng. (42) Heating, Vent.	3.		

THESIS

COURSE IN CERAMICS

The ceramic industries include, according to the classification here adopted, those in which the production and utilization of natural and artificial silicates is the end in view; viz, clayware, glass, and cement. These three industries constitute a natural division of chemical technology.

Ceramic Engineering is the application of chemical technology and general engineering to this special group of non-metallic mineral industries. The ceramic engineer is supposed to be enough of a geologist to inspect a tract of country and determine whether it possesses mineral resources suited to silicate manufacture, and enough of a mining engineer to be able to economically win the deposits found, whether they are to be quarried superficially or mined deep in the earth. He must be enough of a mechanical engineer to transport, prepare, and manufacture these substances into their appropriate forms, rapidly and cheaply. Above all, he must be enough of a chemist to understand the nature of the processes taking place in kilns and furnaces, both as regards the generation of heat, and the formation of new silicate minerals from the earthy raw materials. The intimate relation existing between the composition and properties of silicate products throughout all ceramic operations, and the use of chemical control for maintaining these relations constant, makes the training of the chemical laboratory absolutely necessary to the safe and progressive management of any modern ceramic industry.

These demands are broad and varied, but not more so than those of chemical engineering in general. The field of ceramic engineering is comparatively new in this country, the first course being offered in 1896. The demand for trained men in these industries is not yet as firmly established as in the well-known engineering branches, and ceramic engineers are compelled to a certain extent to act as pioneers in the field. Their employment on a constantly increasing scale is regarded as certain.

FOR OUTLINE OF FIRST YEAR SEE PAGE 29.

SUMMER TERM.—Students are required to take *two* of the following courses in shopwork in the summer term at the close of the first year: Shopwork (4) (7) and (11).

SECOND YEAR

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (39) Drafting, etc.	3.
Mathematics (41) Calculus.	5.	Mathematcs (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Physics (3) Problems.	2.	Physics (3) Problems.	2.	Physics (3) Problems.	2.
Ceramics (1) Laboratory.	5.	Ceramics (2) Laboratory.	5.	Ceramics (3) Laboratory.	5.
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

THIRD YEAR

Mathematics (71) Statics.	5.	Mathematics (72) Str'n'th Mat'ls, Kinet's	5.	Mathematics (73) Kinetics, Hydraulics	5.
Ceramics (4) Raw Materials.	5.	Ceramics (5) Clay Products.	5.	Ceramics (6) Clay Products.	5.
Mine Eng. (4) Mine Surveying.	5.	Mech. Eng. (37) Mechanism.	4.	Ceramics (7) Adv. Chem. Lab.	5.
English (2) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.

FOURTH YEAR

Ceramics (9) Manf. of Bodies.	5.	*Ceramics (10) Glasses and Glazes.	5.	*Ceramics (11) Enamels, Colors.	5.
Metallurgy (4) Fuels and Iron.	5.	*Ceramics (12) Cement.	5.	*Ceramics (18) Cement Laboratory.	5.
		Ceramics (22) Physical Chem.	3.	Ceramics (15) Thesis Work.	5.
Geology (2) General.	5.	Geology (6) Economic.	3.	Mech. Eng. (36) Laboratory.	5.
		Geology (7) Petrography.	2.		
Drawing (7) Photography.	2.	Drawing (22) Technical Draw.	2.	Drawing (23) Technical Draw.	2.

THESIS

*Students are to elect Ceramics (10) and (11) or Ceramics (12) and (18).

COURSE IN CHEMICAL ENGINEERING

This course has been prepared to meet the growing demands for trained men in the numerous industries which are based upon chemical processes or employ them prominently in their work, and which are not included in the fields of metallurgy and ceramics. Among such may be mentioned the manufacture of acids, alkalies, salts, chemical reagents, paints, colors, dyes, bleaching powders, soaps, glue, gelatin, glycerine, tanning compounds, starch, sugar, dextrine, glucose, alcohol, ferments, preservatives, antiseptics, fertilizers, matches, and many others.

Much of this work has been done in the past without the aid of the chemist. At present it is recognized, however, that in order to carry on the work economically and compete with other countries, the service of the chemist is indispensable. Not only is he able to improve the methods and obtain better products, but he is often able to devise methods for utilizing the by-products and thus lower the cost of production.

The course differs from the ordinary course in chemistry in that it is extended greatly along the engineering lines. This is in accord with the views of the manufacturers as well as experts in technical chemistry. The manufacturer must not only understand the chemical reactions involved in processes; he must be able to devise machinery for carrying out these reactions on a large scale. Nearly all chemical industries are conducted by the aid of elaborate plants for mechanically treating the materials and handling the products, which in many cases cannot be dealt with by hand labor. Consequently mechanical engineering, and to a limited extent, electrical engineering, is demanded and used in these industries. The men at present entering these lines of work are largely mechanical engineers, well trained in this side of the work, but weak and inefficient on the chemical side, which is really fundamental.

FOR OUTLINE OF FIRST YEAR SEE PAGE 29.

SUMMER TERM.—Shopwork Courses (7) 3 and (11) 3 are to be taken in the summer term at the close of the first or second year.

SECOND YEAR

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Chemistry (20) Quantitative.	4.	Chemistry (20) Quantitative.	4.	Chemistry (20) Quantitative.	4.
Chemistry (21) Inorganic.	2.	Chemistry (21) Inorganic.	2.	Chemistry (21) Inorganic.	2.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Metallurgy (2) Mineralogy.	3.
		Chemistry (40) Problems.	1.	Chemistry (40) Problems.	1.
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

THIRD YEAR

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Chemistry (8) Organic.	5.	Chemistry (9) Organic.	5.	*Chemistry (9) Organic.	5.
Metallurgy (5) Laboratory.	5.	Metallurgy (6) Assaying.	5.	*Metallurgy (5) Laboratory.	5.
English (2) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.
Mathematics (71) Statics.	5.	Mathematics (72) Str'n'th Mat'ls, Kinet's	5.	Mathematics (73) Kinetics, Hydraulics	5.
Drawing (21) Technical.	2.	Drawing (22) Technical.	2.	Drawing (23) Technical.	2.
				Mech. Eng. (32) Power Plants.	5.

FOURTH YEAR

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours.
Chemistry (32) Industrial.	4.	Chemistry (32) Industrial.	4.	Chemistry (15) Sanitary.	4.
Mech. Eng. (18) Machine Design.	5.	Mech. Eng. (18) Machine Design.	5.	Mech. Eng (19) Machine Design.	5.
Elec. Eng. (6) Lectures.	2.	Chemistry (30) Physical.	3.	Chemistry (30) Physical.	3.
Elec. Eng. (7) Laboratory.	2.	†Mech. Eng. (35) Laboratory.	5.		
†Metallurgy (4) Fuels and Iron.	5.	†Metallurgy (4) General.	5.	Ceramics (16) General Principles.	5.
†Chemistry (35) Rare Elements.	3.				

THESIS

*Students are to elect either Chemistry (9) 5, or Metallurgy (5) 5

†Students are to elect Metallurgy (4), two terms; Metallurgy (4) first term, and Mechanical Engineering (35); or Chemistry (35) and Mechanical Engineering (35).

COURSE IN CIVIL ENGINEERING

Among the special fields which are usually included under the title Civil Engineering, are those of Bridge Engineering, Railroad Construction and Maintenance of Way, Sanitary Engineering, Public Water Supply and Irrigation Engineering, and other special branches, such as Topographic and Geodetic Surveying.

The course of instruction is designed to provide the foundation upon which all of these specialties are built. The first two years are, therefore, devoted to the fundamental sciences, to drawing, and to mensuration, and afford an excellent short course in Surveying for those expecting to become deputy county surveyors, or to engage in private practice as land surveyors.

During the third and fourth years, attention is turned to engineering proper, and the drafting and sciences studied during these years apply directly to the art of construction as practiced in each of the specialties of highway, railway, masonry, bridge, sanitary, and hydraulic engineering.

To keep the course in close touch with practice, the department attempts to make each graduate proficient with the instruments of his profession by requiring attendance at Summer surveying camp for two terms of four weeks each, at the end of the second and third years, or submitting suitable experience with some practicing engineer in lieu thereof; by means of work in well-equipped laboratories; and by completing a satisfactory thesis on some practical theme. Much valuable training is to be had from suitable thesis work, and students are urged to begin this during their third year, or the vacation following. The laboratories of the department include facilities for extended work in investigating cements and reinforced concrete, for investigating road materials, and for rating meters and doing other hydrographic work. The remaining laboratories of the college give the student facility in testing other materials of construction, and familiarize him with the elements of steam and electrical engineering practice.

FOR OUTLINE OF FIRST YEAR SEE PAGE 29.

SECOND YEAR

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours
Drawing (33) Projections.	3.	Drawing (36) Descriptive Geom.	5.	Drawing (35) Shades, Shadows.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Civil Eng. (1) Land Surveying.	6.	Civil Eng. (4) Topog. Drawing.	4.	Civil Eng. (2) Railroad Surveying.	6.
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

SUMMER COURSE.—Civil Engineering (22) 4 weeks, of 6 days per week. Field work in land and railroad surveying.

THIRD YEAR

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours
Mathematics (71) Statics.	5.	Mathematics (72) Str'n'th Mat'ls, Kinet's	5.	Mathematics (73) Kinetics, Hydraulics	5.
Civil Eng.. (3) Topog. Surveying.	4.	Civil Eng. (24) C. E. Drawing.	5.	Civil Eng. (7) Bridge Stresses.	5.
Civil Eng. (16) Roads and Streets.	5.	Civil Eng. (6) Stereotomy.	4.	Drawing (7) Photography.	2.
Astronomy (4) Mathematical.	3.	Astronomy (5) Mathematical.	3.	Astronomy (6) Mathematical.	4.
English (2) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.

SUMMER COURSE.—Civil Engineering (23) 4 weeks, of 6 days per week. Field work in railroad and topographical surveying.

FOURTH YEAR

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours
Civil Eng. (8) Bridge Designing.	5.	*Civil Eng. (17) Railways.	5.	Civil Eng. (18) Water Supply.	5.
		*Civil Eng. (25) Adv. Bridge Work.	5.		
Civil Eng. (15) Masonry.	5.	Civil Eng. (14) Cement Testing.	2.	Civil Eng. (10) Sanitary Eng.	5.
Elec. Eng. (6) Lectures.	2.	Elec.Eng.(6 and 7) Lectures and Lab.	4.		
		Mech. Eng. (17) Laboratory.	3.	Mech. Eng. (25) Laboratory.	5.
Geology (2) General.	5.	Geology (6) Economic.	3.		

THESIS

*Students are to elect either Civ. Eng. (17) or Civ. Eng. (25).

COURSE IN ELECTRICAL ENGINEERING

The object of this course is to give such training as shall enable the graduate to successfully take up practical work in those branches of engineering in which electricity plays the principal part. In general, the training needed for this purpose is similar to that of the mechanical engineer, except that the student is not expected to become expert in all the fields of mechanical engineering, but must have a good knowledge of the whole subject of power generation, transmission, and transformation, especially in its electrical form.

The constantly widening field wherein electrical methods are being adopted is making an ever-increasing demand for the graduates of technical colleges. Among the industries where electricity is coming into use, perhaps none is more far-reaching or important than electric railroading. Furthermore, the substitution of electricity upon steam roads is beginning, and it would be a bold man who would set a limit to the progress of this movement. Akin to the above is the use of electric power for the transmission of material over short distances, as in the case of mines, shop railway cranes, etc. The driving of machine shops by electricity, although it has become the standard method, and is being installed in all new shops of importance, has yet a wide field for development. In the telephone industry both the manufacturing and operating companies are calling for technical graduates in ever larger numbers, and the engineering side of this work offers a field than which there is perhaps none more interesting. To the electrical engineering graduate there are opened up several different kinds of work. On the one hand the manufacturing companies require men for their engineering, commercial, and manufacturing departments; on the other, a large field is open among the different operating companies. Then, too, some graduates obtain positions with construction companies.

FOR OUTLINE OF FIRST YEAR SEE PAGE 29.

SUMMER TERM.—Students are required to take *two* of the following courses in shopwork in the summer term at close of first year: Shopwork (4), (7) and (11).

SECOND YEAR

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Physics (3) Problems.	2.	Physics (3) Problems.	2.	Physics (3) Problems.	2.
Shop (4, 7 or 11)	3.	Shopwork (13) Machine Work.	3.	Physics (5) Laboratory.	4.
English (2) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

THIRD YEAR

Mathematics (71) Statics.	5.	Mathematics (72) Str'n'th Mat'ls, Kinet's	5.	Mathematics (73) Kinetics, Hydraulics	5.
Physics (6) Laboratory.	5.	Physics (6) Laboratory.	5.	Mech. Eng. (32) Power Plants.	5.
Physics (4) Elect'y, Magnetism.	3.	Mech. Eng. (37) Mechanism.	4.	Mech. Eng. (28) Laboratory.	2.
Shopwork (14) Machine Work.	3.	Elec. Eng. (8) D. C. Machinery.	4.	Elec. Eng. (9) Laboratory.	4.
Drawing (5) Technical.	3.			Elec. Eng. (15) A. C. Machinery.	2.

Elec. Eng. (20), (21), (22) or (23) is taken at the end of the winter term.

FOURTH YEAR

Elec. Eng. (16) A. C. Machinery.	3.	Elec. Eng. (17) A. C. Machinery.	2.	Elec. Eng. (19) Designing.	4.
Elec. Eng. (11) Laboratory.	3.	Elec. Eng. (11) Laboratory.	3.	Elec. Eng. (11) Laboratory.	3.
Mech. Eng. (33) Engines and Boilers.	5.	Elec. Eng. (18) Elec. Design.	3.	Elec. Eng. (25) Transmission.	2.
Mech. Eng. (29) Laboratory.	3.	Elec. Eng. (24) Applications.	2.	*Elec. Eng. (26) Railways.	3.
		Mech. Eng.. (30) Laboratory.	2.	*Elec. Eng. (27) Telephony.	3.
		Ind. Arts (9) Mach. Design.	2.		
†Elective	3-5	†Elective	3-5	†Elective	3-5

Elec. Eng. (20), (21), (22) or (23) is taken at the end of the winter term.

THESIS

*Alternative Course.

†Subject to the approval of the professor of Electrical Engineering.

COURSE IN INDUSTRIAL ARTS

This course is designed for those who may desire to occupy positions in the various branches of manufacture, not as engineers, but as practical managers, superintendents or business men.

As the growth of engineering has brought about its subdivision into many special lines, such as civil, mechanical, electrical, mining, and chemical engineering, and established special training for each, so the increase in size, importance and scope of the manufactures of the country has made it desirable to especially train young men with reference to filling positions of trust and responsibility in them; to so educate them that they can readily learn the treatment or processes in any special line of manufacture and be able to intelligently superintend; and can initiate and put into successful operation new industrial enterprises.

With this idea in view, this course has been planned to give the student special training along industrial and business lines, together with a certain amount of general culture. There will be found in this course a large amount of science training by which the processes of manufacture based upon these laws may be more readily understood; practice in the different shops and in drawing, so that a good working knowledge of such operations may be acquired, as well as training given to eye and hand, and power of observation and thought developed along mechanical lines; studies into the principles and methods governing the production of the chief materials of construction, the different mechanical movements and their combinations in machinery, the use of materials in various constructions, electrical machinery and steam power plants, together with laboratory practice; also the relations of capital and labor, the problems of trade, and the conduct of business enterprises.

FOR OUTLINE OF FIRST YEAR SEE PAGE 29.

SECOND YEAR

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Physics (3) Problems.	2.	Physics (3) Problems.	2.	Physics (3) Problems.	2.
Shopwork (7) Woodwork.	3.	Shopwork (9) Adv. Pattern M'king	3.	Shopwork (8) Cabinet Work.	3.
Shopwork (3) Foundry.	3.	Shopwork (11) Forging.	3.	Shopwork (12) Adv. Forging.	3.
English (2) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.
Economics (30) Indus. and Soc. Hist.	3.	Economics (31) Indus. and Soc. Hist.	3.	Economics (32) Com. and Econ. Geog.	3.
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

THIRD YEAR

Drawing (5) Technical.	3.	Industrial Arts (2) Designing.	3.	Industrial Arts (2) Designing.	3.
Industrial Arts (1) Tools and Machines.	3.	Industrial Arts (1) Tools and Machines.	3.	Industrial Arts (1) Tools and Machines.	3.
Shopwork (4) Chipping and Filing.	3.	Shopwork (13) Machine Work.	3.	Shopwork (14) Machine Work.	3.
Metallurgy (4) Fuels and Iron.	5.	Metallurgy (4) Steel.	2.	Mech. Eng. (32) Power Plants.	5.
Economics (33) Elem. of Polit. Econ.	3.	Economics (33) Elem. of Polit. Econ.	3.	Economics (33) Elem. of Polit. Econ.	3.
		Civil Eng. (27) Timber and Masonry.	3.		

FOURTH YEAR

Shopwork (15) Adv. Mach. Work.	3.	Shopwork (16) Adv. Mach. Work.	3.	Shopwork (17) Adv. Mach. Work.	3.
Elec. Eng. (6) Lectures.	2.	Elec. Eng. (6) Lectures.	2.	Civil Eng. (21) Surveying.	3.
Elec. Eng. (7) Laboratory.	2.	Elec. Eng. (7) Laboratory.	2.		
Industrial Arts (3) Shop Equipment.	3.	Industrial Arts (3) Shop Appliances.	3.	Industrial Arts (3) Shop Management.	3.
Industrial Arts (4) Adv. Designing.	3.	Industrial Arts (4) Adv. Designing.	3.	Industrial Arts (4) Adv. Designing.	3.
Mech. Eng. (12) Laboratory.	2.	Mech. Eng. (29) Laboratory.	2.	Mech. Eng. (30) Laboratory.	2.
Economics (37) Ind. Org'nizat'n, etc.	3.	Economics (38) Ind. Concen., etc.	3.	Economics (39) Lab. Organ., etc.	3.

THESIS

COURSE IN MANUAL TRAINING.

This course is designed for those who wish to become teachers of manual training in the public schools of secondary grade or in technical schools. It is necessary that a teacher of manual training in the public schools be of the same high standard as his associates in character, general culture, and uplifting influence. He must possess knowledge of the methods of instruction and ability in the art of teaching; and coupled with these, he must have skill in his technical lines. He must be familiar with the tools, materials and processes used, and acquainted with the different effects on his pupils of the training and work with these. He must understand that enlarged power and ability in the student is what he is seeking; that the pupil himself and not the inanimate object used is the real product of his efforts.

The value of manual training as a needed factor in the education of modern days is recognized. In the old times, when so many machine-made articles were not in the market, and living was not so diversified, the children of the family received their manual training at their homes and under their parents as teachers. There were the household duties assigned to them and things to be made and repaired and ideas of improvements to be wrought out. These were done with a good deal of hand work, and a valuable training was obtained. Now this training is brought about by the introduction of manual work into the schools from the lowest to the highest grades. In the higher grades the materials used in the manual training are those in common use, wood and iron; and the principles underlying the working of them in the various industries are studied and practiced.

As the work is arranged in the course offered, the student is well grounded in the sciences of mathematics, physics and chemistry, and can plan his manual training work to help more directly the other lines of work of his pupils.

FOR OUTLINE OF FIRST YEAR SEE PAGE 29.

SECOND YEAR

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Physics (3) Problems.	2.	Physics (3) Problems.	2.	Physics (3) Problems.	2.
Shopwork (7) Woodwork.	3.	Shopwork (9) Adv. Pattern M'k'ng	3.	Shopwork (8) Cabinet Work.	3.
Shopwork (3) Foundry.	3.	Shopwork (11) Forging.	3.	Shopwork (12) Adv. Forging.	3.
English (2) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.
Education (1) Elem. Psychology.	3.	Education (1) Elem. Psychology.	3.	Education (1) Elem. Psychology.	3.
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

THIRD YEAR

Drawing (5) Technical.	3.	Industrial Arts (2) Designing.	3.	Industrial Arts (2) Designing.	3.
Industrial Arts (1) Tools and Machines.	3.	Industrial Arts (1) Tools and Machines.	3.	Industrial Arts (1) Tools and Machines.	3.
Shopwork (4) Chipping, Filing.	3.	Shopwork (13) Machine Work.	3.	Shopwork (14) Machine Work.	3.
History (1) U. S. Political.	3.	History (1) U. S. Political.	3.	History (1) U. S. Political.	3.
*Chemistry (20) Quantitative.	4.	*Chemistry (20) Quantitative.	4.	*Chemistry (20) Quantitative.	4.
*Chemistry (21) Physical.	2.	*Chemistry (21) Physical.	2.	*Chemistry (21) Physical.	2.
*Physics (5) Laboratory.	5.	*Physics (5) Laboratory.	5.	*Physics (5) Laboratory.	5.

FOURTH YEAR

Shopwork (15) Adv. Mach. Work.	3.	Shopwork (16) Adv. Mach. Work.	3.	Mech. Eng.. (32) Power Plants.	5.
Elec. Eng. (6) Lectures.	2.	Elec. Eng. (6) Lectures.	2.	Mech. Eng. (28) Laboratory.	2.
Elec. Eng. (7) Laboratory.	2.	Elec. Eng. (7) Laboratory.	2.		
Education (5) Science of Educ.	3.	Education (5) Science of Educ.	3.	Education (5) Science of Educ.	3.
Polit. Science (1) Polit. Inst. of U. S.	3.				
Electives	2-5	Electives	5-7.	Electives	5-7.

THESIS

*Students take either Chemistry (20) and (21) or Physics (5).

COURSE IN MECHANICAL ENGINEERING.

Mechanical engineering deals with the generation of power from the forces of nature and the utilization of this power in machinery by means of mechanism for the manufacture of different products. Physics is the fundamental science underlying this profession, especially those parts of physics relating to mechanics and heat. Chemistry is required for understanding the constitution of the materials used and for the changes which take place during combustion. Mathematics is the tool by which scientific principles are made applicable to practical engineering problems.

One of the great fields of mechanical engineering is the generation of power by means of the steam boiler, steam engine, and steam turbine. The great advances of the past century have been made possible by improvements in these lines. Recently a rival has sprung up for steam; the field of gas engineering, which includes the manufacture and utilization of fuel in gaseous form directly in the engine, will probably furnish sweeping changes in the generation of power. The utilization of water power and the power of the wind also form fields for the mechanical engineer. The application of the power, whatever its manner of generation, can be had either directly by pumps, air compressors and electrical machinery, or indirectly through shafting, belting, and ropes. These applications furnish other opportunities. The machinery called for and designed by the mechanical engineer includes all that is used in the different industrial establishments, from the large machines found in rolling mills, steel works, and heavy manufacturing establishments, to the delicate machinery used in the manufacture of watches. Still another branch includes such allied subjects as heating, ventilation, and refrigeration.

The training given is designed to equip men with such general and technical knowledge that they can take up the work in any of the branches of the profession.

FOR OUTLINE OF FIRST YEAR SEE PAGE 29.

SECOND YEAR

SUMMER TERM.—Students are required to take *two* of the following courses in shopwork in the summer term at the close of the first year: Shopwork (4), (7) and (11).

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Shopwork (3) Foundry.	2.	Physics (7) Laboratory.	2.	Physics (7) Laboratory.	3.
English (2) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.
Shopwork (4, 7, 9, or 11)	3	Shopwork (4, 9, or 11)	3.	Shopwork (13) Machine Work.	3.
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

THIRD YEAR

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours
Mathematics (71) Statics.	5.	Mathematics (72) Str'n'th Mat'ls, Kinet's	5.	Mathematics (73) Kinetics, Hydraulics.	5.
Mech. Eng. (12) Laboratory.	2.	Mech. Eng. (3) Mechanism.	5.	Mech. Eng. (3) Mechanism.	2.
Drawing (5) Technical.	3.	Civil Eng. (27) Timber, Masonry.	3.	Drawing (7) Photography.	2.
Metallurgy (4) Fuels and Iron.	5.	Metallurgy (4) Steel.	2.	Civil Eng. (19) Trusses.	5.
Shopwork (14) Machine Work.	3.	Shopwork (15) Adv. Machine Work.	4.	Mech. Eng. (32) Power Plants.	5.
Mathematics (11) Diff. Equations.	1.				

Mech. Eng. (38), (39), (40) or (41) is taken at the end of the winter term.

FOURTH YEAR

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours
Mech. Eng. (33) Engines and Boilers.	5.	Mech. Eng. (34) Thermodynamics.	5.	Mech. Eng. (21) Thesis.	5.
Mech. Eng. (27) Laboratory.	5.	Mech. Eng. (14) Laboratory.	4.	Mech. Eng. (15) Laboratory.	3.
Mech. Eng. (18) Machine Design.	5.	Mech. Eng. (18) Machine Design.	5.	Mech. Eng. (19) Machine Design.	5.
Elec. Eng. (6) Lectures.	2	Elec. Eng. (6) Lectures.	2.	Mech. Eng. (31) Hydraulic Mach.	3.
Elec. Eng. (7) Laboratory.	2.	Elec. Eng. (7) Laboratory.	2.	Industrial Arts (5) Shop Appliances.	3.

THESIS

Mech. Eng. (38), (39), (40) or (41) is taken at the end of the winter term.

COURSE IN MINE ENGINEERING.

The profession of mine engineering involves two distinct fields, that of the engineer and that of the metallurgist. A man may devote himself to either of these departments, but a competent understanding of both is essential to the successful designing and development of mining or metallurgical plants.

On the engineering side the work is directed to the excavation and working of mineral resources. In this are involved the geological features of the locality; the opening of the property; the mechanical handling of the ores or coal; the surveying and mapping of the mining operations, and the proper drainage and ventilation of the mine.

In its metallurgical aspects, mine engineering is confined to the reduction of the metals from their ores, the manufacture and alloying of the metals, and the treatment and utilization of fuels from the standpoint of the effective generation of a calorific power rather than the conversion of the power to other forms of energy.

The professional outlook for the mine engineer is good. The development of coal mining has given rise to a considerable demand for trained men to have charge of the engineering work involved and ultimately for the general management of the business. The widely distributed fields for the mining of metallic minerals and the special and somewhat isolated character of many of the plants, make the training of the mine engineer of special importance in their management. In connection with the larger reduction plants, with steel manufacture, and with iron blast furnaces, there is a growing demand for men trained as metallurgical chemists. The industries dealing with the treatment and smelting of ores are growing rapidly and are in need of trained men.

FOR OUTLINE OF FIRST YEAR SEE PAGE 29.

SECOND YEAR

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Metallurgy (5) Laboratory.	5.	Metallurgy (5) Laboratory.	5.	Metallurgy (5) Laboratory.	5.
Shopwork (7) Woodwork.	2.	Shopwork (11) Forging.	2.	Metallurgy (2) Mineralogy.	3.
Military Drill, Gymnasium.		Military Drill,		Military Drill.	

THIRD YEAR

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours
Mathematics (71) Statics.	5.	Mathematics (72) Str'n'th Mat'ls, Kinet's	5.	Mathematics (73) Kinetics, Hydraulics	5.
Metallurgy (4) Fuels and Iron.	5.	Metallurgy (4) General.	5.	Metallurgy (3) Deter. Mineralogy.	5.
Mine Eng. (4) Mine Surveying.	5.	Metallurgy (6) Assaying.	5.	Civil Eng. (19) Trusses.	5.
English (2) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.
		Mine Eng. (7) Surveying.	1.		

FOURTH YEAR

FIRST TERM.	Credit hours.	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours
Mine Eng. (5) Mine Engineering.	5.	Mine Eng. (5) Mine Engineering.	5.	Mine Eng. (5) Mine Engineering.	5.
Geology (2) General.	5.	Geology (6) Economic.	3.	Mech. Eng. (36) Laboratory.	5.
Metallurgy (8) Ore Dressing.	2.	Metallurgy (7) Metal. Construction.	3.	Mine Eng. (6) Plans and Spec.	5.
Elec. Eng. (6) Lectures.	2.	Elec. Eng. (6) Lectures.	2.	Drawing (7) Photography.	2.
Elec. Eng. (7) Laboratory.	2.	Elec. Eng. (7) Laboratory.	2.		
		Geology (7) Petrography.	2.		

THESIS

COURSES NOT LEADING TO A DEGREE

The following short courses are offered by the University in the belief that they will meet the needs of a large class of young men who for some reason will not or cannot obtain the benefits of the thorough courses already described. The University recognizes that there are many valid reasons which may stand in the way of some, whose ability to receive and to use the highest forms of education is without question; and it is thought that in extending opportunities for such training as will be available to these young men, the University is filling a long felt want in the scheme of engineering education, and is certain to grow into closer contact with the industrial life of the State.

To one completing these courses, a certificate is issued stating the studies in which work has been satisfactorily done.

The requirements for admission to these short courses are very much lower than for admission to regular collegiate work. It is clear that to reach the young men for whom these courses have been designed, it is necessary that the conditions of admission and attendance shall be shorn of every complication and that the opportunity extended shall be within the grasp of all, and with the minimum of formality or restriction.

The somewhat elementary character of some of the work of these courses may attract the attention of some, who as candidates for admission to regular collegiate work, could not be admitted on account of their insufficient preparation. To all such students it is proper to state that these courses are in no sense designed as preparatory schools for those who desire ultimately to enter college, and it is not the purpose to permit such use to be made of them. For the detailed requirements for admission to these short courses, see page 26.

The two-year course is designed to assist young men who have already been actively engaged in the Ceramic industries, and who, on account of mature years, or lack of means, or lack of previous educational advantages, are unable to avail themselves of the full and complete course, and yet who wish to increase their earning power or chances of promotion by fitting themselves for other than routine labor. This course comes into as close a touch with the wants of the clay industries as is possible in so brief a time. It is intended to make its benefits available to the greatest number.

NOTE.—The figure in parenthesis following the name of each study indicates the number of the study in its department. A full description of department work follows this statement of Courses.

FIRST YEAR

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours
Chemistry (3) Inorganic.	5.	Chemistry (3) Inorganic.	5.	Chemistry (12a) Quantitative.	5.
Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.
Mathematics (3) Plane Geom.	5.	Mathematics (13) Space Geom.	5.	Mathematics (14) Trigonometry.	5.
Drawing (2) Lettering.	3.	Drawing (38) Projections.	3.	Drawing (39) Drafting.	3.
Military Drill.		Military Drill, Gymnasium.		Military Drill.	

SUMMER TERM.—Students are required to take Shopwork (7) and (11) in the summer term at the end of the first year. But they may be excused from this where they are able to obtain positions in some ceramic establishment for the summer; and on presentation of a satisfactory certificate, endorsed by the head of the department, work in a ceramic factory during the summer may be counted as equivalent to the summer shop course.

SECOND YEAR

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours
Ceramics (1) Chem. Lab.	5.	Ceramics (2) Chem. Lab.	5.	Ceramics (19) Chem. Lab.	5.
Ceramics (4) Raw Materials.	5.	Ceramics (5) Clay Products.	5.	Ceramics (6) Clay Products.	5.
Physics (1) Elementary.	5.	Physics (1) Elementary.	5.	Ceramics (23) Laboratory.	7.
Ceramics (20) Laboratory.	2.	Ceramics (21) Laboratory.	2.		
Military Drill, Gymnasium.		Mlitary Drill.		Military Drill.	

This course is primarily designed to extend the benefits of the same kind of training as that given in the four-year course in this subject to that class of young men who may be unable for any reason to undertake a course of four years' duration, but who aspire to become actively engaged in factory work. It has been the aim to give, in as condensed form as possible, those studies which will most rapidly and easily be turned to practical account in manufacturing operations.

This course will be found most valuable to young men already engaged in factory work, who find themselves limited from rising in their work on account of lack of technical education.

NOTE.—The figure in parenthesis following the name of each study indicates the number of the study in its department. A full description of department work follows this statement of Courses.

FIRST YEAR

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours
Drawing (24) Freehand.	1.	Drawing (25) Freehand.	1.	Drawing (26) Freehand.	1.
Drawing (2) Lettering.	3.	Drawing (38) Projections.	3.	Drawing (39) Drafting.	3.
Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.
Mathematics (3) Plane Geometry.	5.	Mathematics (13) Space Geometry.	5.	Mathematics (14) Trigonometry.	5.
Shopwork (7) Pattern Making.	3.	Shopwork (9) Adv. Pattern M'k'ng	3.	Shopwork (11) Forging.	3.
Military Drill.		Military Drill, Gymnasium.		Military Drill.	

SECOND YEAR

Industrial Arts (8) Machine Drawing.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Industrial Arts (1) Tools, Machines.	3.	Industrial Arts (1) Tools, Machines.	3.	Industrial Arts (1) Tools, Machines.	3.
Physics (1) Elementary.	5.	Physics (1) Elementary.	5.	Geology (1) Phys. Geography.	5.
Shopwork (4) Chipping, Filing.	3.	Shopwork (13) Machine Work.	3.	Shopwork (14) Adv. Machine Work.	3.
Shopwork (3) Foundry.	2.	Industrial Arts (2) Designing.	3.	Industrial Arts (2) Designing.	3.
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

The short course in mining is especially designed for young men who have had practical experience in mines and wish to study mine surveying, drafting, the problems of ventilation, drainage, haulage, mine operating, etc., and also something of the sciences bearing upon their work, but have neither time nor preparation for a full college course. The first year is devoted to a thorough study of the elementary mathematics and sciences necessary to prepare the student for the practical work of the second year. Experience has shown beyond any doubt that any enterprising young miner can master the subject sufficiently well in the time assigned to materially increase his earning capacity and chances for promotion in his occupation.

Personal instruction is given, and it is made thoroughly practical and of such a character as to best adapt it to the needs of the individual student.

NOTE.—The figure in parenthesis following the name of each study indicates the number of the study in its department. A full description of department work follows this statement of Courses.

FIRST YEAR

FIRST TERM.	Credit hours	SECOND TERM.	Credit hours	THIRD TERM.	Credit hours
Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.
Mathematics (3) Geometry.	5.	Mathematics (13) Space Geometry.	5.	Mathematics (14) Trigonometry.	5.
Physics (1) Elementary.	5.	Physics (1) Elementary.	5.	Geology (1) Phys. Geography.	5.
Military Drill.		Military Drill, Gymnasium.		Military Drill.	

SECOND YEAR

Drawing (2) Lettering.	3.	Drawing (38) Projections.	3.	Drawing (39) Drafting.	3.
Drawing (27) Freehand.	2.	Geology (4) Elementary.	5.	Shopwork (11) Forging.	3.
Chemistry (3) Inorganic.	5.	Chemistry (3) Inorganic.	5.	Metallurgy (9) Mineral Chemistry.	5.
Mine Eng. (1) Mine Surveying.	5.	Mine Eng. (2) Ventilat. Haulage.	5.	Mine Eng. (3) Mine Operating.	5.
		Mine Eng. (7) Surveying.	1.		
Military Drill. Gymnasium.		Military Drill.		Military Drill,	

DEPARTMENTS OF INSTRUCTION

ARCHITECTURE AND DRAWING

Office, Room 22, Brown Hall.

Professor Bradford, Associate Professor French, Assistant Professor Lewis, Assistant Professor Major, Mr. Martin, Mr. Tidball, Mr. Rogers, Mr. Meiklejohn.

The department work in Architecture is carried on in Brown Hall. The well-lighted designing rooms are equipped with the needed tables, lockers, etc., and the lecture room is provided with an electric projection lantern. The department has much material for consultation and study, including models in plaster and wood illustrating the constructive and ornamental forms of different styles of architecture, photographs and lantern slides, drawings and specifications of erected structures, plates of architectural forms and ornaments, samples of building material. Various structures are continually in process of erection in the city and furnish examples of practical nature.

The Mechanical Drawing and Photography are taught in Brown Hall. For the Mechanical Drawing there are four large, well-lighted drafting rooms with necessary tables and lockers, and two lecture rooms equipped with electric projection lantern. A set of Schroeder models and a collection of shop drawings are available. There are two blue-print rooms, one provided with an Elliott electric light printing machine, the other with sun frames. For Photography there is an especially built dark room with forty-three developing compartments; also two laboratories equipped with toning and mounting tables; printing apparatus, copying cameras, lenses of long and short focus, tele-photographic lens, color screens, shutters, and an excellent outfit for photo-micrography.

The Freehand Drawing, Painting, and Modeling are carried on in Hayes Hall. The rooms are equipped with the usual tables, models and casts, easels, modeling tools and other needed apparatus.

BROWN HALL.

THE
[illegible] CR
LIBRARY

ARCHITECTURE

4. SPECIFICATIONS. Two credit hours. Lectures and practice in preparing specifications for architectural structures. Course in Architecture, fourth year, second term, *Tu., 11,* and assigned work. Prerequisite, Architecture 18. PROFESSOR BRADFORD.

5. DECORATION AND ORNAMENT. Three credit hours. Lectures on the different styles of carved ornament and decorative color. The practice part of this subject will be incorporated in the Clay-Modeling and Designing. Course in Architecture, third year, first term, *M., W., 9, F., 9-11.* Prerequisite, Drawing 37 and Architecture 14. PROFESSOR BRADFORD.

6. ESTIMATES AND SUPERINTENDENCE. Four credit hours. Lectures and practice in preparing estimates for structures designed in 11, 12, 13 and 21, and the duties of superintendence. Course in Architecture, fourth year, third term, *M., W., 8, W., 1-5.* Prerequisite, Architecture 21, Concurrent, Architecture 19. PROFESSOR BRADFORD.

9. HISTORY OF ARCHITECTURE. Three credit hours. Lectures illustrated by lantern slides. Course in Architecture, second year, first term, *M., W., F., 11.* PROFESSOR BRADFORD.

10. Continuation of 9. Course in Architecture, second year, second term, *M., W., F., 11.* PROFESSOR BRADFORD.

11. Continuation of 10. Course in Architecture, second year, third term, *M., W., F., 11.* PROFESSOR BRADFORD.

12. ARCHITECTURAL DRAWING. Two credit hours. Drawing architectural ornament, details of orders and styles, with the special object of impressing upon the student's mind the architectural characteristics considered in Course 9. Course in Architecture, second year, first term, *W., Th., F., 2-4.* Concurrent, Drawing 33 and Architecture 9. PROFESSOR BRADFORD.

13. Continuation of 12. Course in Architecture, second year, second term, *W., Th., F., 2-4.* Concurrent, Architecture 10. PROFESSOR BRADFORD.

14. Continuation of 13. Course in Architecture, second year, third term, *W., Th., F., 2-4.* Concurrent, Architecture 11. PROFESSOR BRADFORD.

15. DESIGNING. Suburban dwellings. Four credit hours. Lectures and practice. Course in Architecture, third year, first term, *W., Th., 1-4, F., 1-3.* Prerequisite, Architecture 14, and Drawing 37. PROFESSOR BRADFORD.

17. DESIGNING. School buildings. Four credit hours. Course in Architecture, third year, third term, *W., Th., 1-4, F., 1-3.* Prerequisite, Architecture 23. PROFESSOR BRADFORD.

18. DESIGNING. Public buildings. Four credit hours. Course in Architecture, fourth year, first term, *Th., F., 1-5.* Prerequisite, Architecture 17. PROFESSOR BRADFORD.

19. DESIGNING. Ecclesiastical architecture. Four credit hours. Course in Architecture, fourth year, third term, *Th., 11, Th., F., 1-4.* Prerequisite, Architecture 21. PROFESSOR BRADFORD.

20. THESIS. Five credit hours. Original design to be accompanied with written description, specifications and estimate. Course in Architecture, fourth year, third term.

21. ARCHITECTURE OF TALL SKELETON-CONSTRUCTED BUILDINGS. Two credit hours. Course in Architecture, fourth year, second term, *Th., 11, F., 1-3.* Prerequisite, Architecture 18. Concurrent, Civil Engineering 28. PROFESSOR BRADFORD.

22. PRINCIPLES OF ARCHITECTURAL COMPOSITION. Two credit hours. Course in Architecture, third year, first term, *Tu., Th., 9.* Concurrent, Architecture 5. PROFESSOR BRADFORD.

23. DESIGNING. Modern apartment houses. Four credit hours. Course in Architecture, third year, second term, *W., Th., 1-4, F., 1-3.* Prerequisite, Architecture 15. PROFESSOR BRADFORD.

24. FRAMING DETAILS. Two credit hours. Course in Architecture, third year, third term, *F., 8-11.* Prerequisite, Architecture 23. PROFESSOR BRADFORD.

25. SANITARY PLUMBING. Two credit hours. Lectures on the principles of sanitary plumbing. Course in Architecture, fourth year, second term, *M., F., 10.*

DRAWING

Office, Brown Hall, Room 42.

2. LETTERING. Practice and occasional lectures. Three credit hours. Short Courses in Clay Working and Industrial Arts, first year; Short Course in Mining, second year, first term, *Th., F., 1-4.* Concurrent, Drawing 24 or 27. MR. ROGERS.

5. TECHNICAL DRAWING. Three credit hours. Rules and methods for making working drawings in machine design to represent correctly form and dimensions for shop use, and for tracing

and blue-printing the same. Courses in Electrical and Mechanical Engineering, Industrial Arts and Manual Training, third year, first term, *M., Tu., 1-4, or Th., F., 1-4.* Prerequisite, Drawing 35. ASSOCIATE PROFESSOR FRENCH, ASSISTANT PROFESSOR MAJOR.

7. PHOTOGRAPHY. Two credit hours. Lectures. Optics of photography, chemistry of photography, exposing and developing, printing lantern slides, orthochromatic photography, and some of the applications of photography. Practice: Outdoor, interior, and instantaneous photography, copying, lantern slides, and printing. Courses in Architecture, third year; Course in Ceramics, fourth year, first term, *M., Tu., 1-3.* Course in Civil and Mechanical Engineering, third year; Course in Mining Engineering, fourth year, third term, *M., Tu., 1-3, or Th., F., 1-3.* Prerequisite, Chemistry 7, and Physics 2. PROFESSOR BRADFORD, ASSISTANT PROFESSOR LEWIS.

14. PEN DRAWING. Two credit hours. Course in Architecture, second year, first term, *M., Tu., 1-3.* Prerequisite, Drawing 26. ASSISTANT PROFESSOR LEWIS.

18. WATER COLOR PAINTING. Two credit hours. Course in Architecture, third year, second term, *Tu., Th., 9-11.* Prerequisite, Drawing 26. MR. MARTIN.

19. WATER COLOR PAINTING. Three credit hours. Course in Architecture, third year, third term, *Tu., Th., 8-10, M., 1-3.* Prerequisite, Drawing 18. MR. MARTIN.

21. TECHNICAL DRAWING. Two credit hours. Course in Chemical Engineering, third year, first term, *W., F., 8-10.* ASSISTANT PROFESSOR MAJOR.

22. TECHNICAL DRAWING. Two credit hours. Course in Chemical Engineering, third year; Course in Ceramics, fourth year, second term, *S., 8-12.* Prerequisite, Drawing 21 or 39. ASSOCIATE PROFESSOR FRENCH.

23. TECHNICAL DRAWING. Two credit hours. Course in Chemical Engineering, third year; Course in Ceramics, fourth year, third term, *S., 8-12.* Prerequisite, Drawing 22. ASSOCIATE PROFESSOR FRENCH.

24. FREE HAND DRAWING. One credit hour. Pencil drawing from models and plaster casts. Practice and occasional lectures. Short Course in Industrial Arts, first year, first term, *W., 1-3.* MR. MARTIN.

25. FREE HAND DRAWING. One credit hour. Brush work from models and plaster casts. Practice and occasional lectures. Short Course in Industrial Arts, first year, second term, *W., 1-3.* All four-year courses, first year, second term. Prerequisite, Drawing 24 or 27. ASSISTANT PROFESSOR LEWIS, MR. MARTIN, MR. TIDBALL.

26. FREE HAND DRAWING. One credit hour. Brush work from plaster casts and still-life. Practice and occasional lectures. Short Course in Industrial Arts, first year, third term, *W., 1-3.* All four-year courses, first year, third term. Prerequisite, Drawing 25. ASSISTANT PROFESSOR LEWIS, MR. MARTIN, MR. TIDBALL.

27. FREE HAND DRAWING. Two credit hours. Pencil drawing from models and plaster casts. Practice and occasional lectures. Short Course in Mining, second year, first term, *W., F., 8-10.* All four-year courses, first year, first term. ASSISTANT PROFESSOR LEWIS, MR. MARTIN, MR. TIDBALL.

31. GEOMETRIC DRAWING. One credit hour. Practice in the use of drawing instruments. All four-year courses, first year, second term. ASSOCIATE PROFESSOR FRENCH, ASSISTANT PROFESSOR MAJOR, MR. ROGERS, MR. MEIKLEJOHN.

32. LETTERING. Two credit hours. Practice and occasional lectures. All four-year courses, first year, third term. Prerequisite, Drawing 31. ASSOCIATE PROFESSOR FRENCH, ASSISTANT PROFESSOR MAJOR, MR. ROGERS, MR. MEIKLEJOHN.

33. PROJECTION DRAWING. Three credit hours. Lectures and practice. Orthographic, isometric, and oblique projections, and elementary working drawings. Second year, first term.

Lectures	Practice	Course in
M., 10	Tu., Th., 9-11	Architecture.
W., 11	M., F., 10-12	Ceramics.
W., 11	M., F., 10-12	Chemical Engineering.
M., 9	Tu., Th., 9-11	Civil Engineering.
Tu., 11	M., F., 10-12	Electrical Engineering.
W., 11	M., F., 10-12	Industrial Arts.
M., 9	M., F., 10-12	Manual Training.
W., 9	M., F., 10-12	Mechanical Engineering.
W., 11	Tu., Th., 9-11	Mine Engineering.

Prerequisite, Drawing 2 or 32. ASSOCIATE PROFESSOR FRENCH, ASSISTANT PROFESSOR MAJOR, MR. ROGERS, MR. MEIKLEJOHN.

34 DESCRIPTIVE GEOMETRY. Three credit hours. Lectures and practice. Second year, second term.

Lectures	Practice	Course in
M., W., 11	F., 10-12	Ceramics.
M., W., 11	F., 10-12	Chemical Engineering.
Tu., Th., 11	F., 10-12	Electrical Engineering.
M., W., 11	F., 10-12	Industrial Arts.
M., W., 8	F., 10-12	Manual Training.
M., W., 11	F., 10-12	Mechanical Engineering.
M., W., 11	Tu., 9-11	Mine Engineering.
M., W., 8	Th., 9-11	Short Industrial Arts.

Prerequisite, Drawing 33 or 38. ASSISTANT PROFESSOR FRENCH, ASSISTANT PROFESSOR MAJOR, MR. ROGERS, MR. MEIKLEJOHN.

35. SHADES, SHADOWS, AND PERSPECTIVE. Three credit hours, second year, third term.

Lectures	Practice	Course in
M., 9	Tu., Th., 9-11	Civil Engineering.
W., 11	M., F., 10-12	Electrical Engineering.
W., 11	M., F., 10-12	Industrial Arts.
M., 8	M., F., 10-12	Manual Training.
M., 11	M., F., 10-12	Mechanical Engineering.
Tu., 11	Tu., Th., 9-11	Mine Engineering.
M., 9	Tu., Th., 9-11	Short Industrial Arts.

Prerequisite, Drawing 34 or 36. ASSOCIATE PROFESSOR FRENCH, ASSISTANT PROFESSOR MAJOR, MR. ROGERS, MR. MEIKLEJOHN.

36. DESCRIPTIVE GEOMETRY. Five credit hours. Course in Architecture and Civil Engineering, second year, second term, *M., W., 8, Tu., Th., 8-11.* Prerequisite, Drawing 33 or 38. ASSOCIATE PROFESSOR FRENCH, ASSISTANT PROFESSOR MAJOR, MR. ROGERS, MR. MEIKLEJOHN.

37. ARCHITECTURAL PERSPECTIVE AND SHADES AND SHADOWS. Five credit hours. Lectures and practice. Course in Architecture, second year, third term, *Tu., Th., 8-12.* Prerequisite, Drawing 36. Concurrent, Architecture 14. PROFESSOR BRADFORD.

38. PROJECTION DRAWING. Three credit hours. Lectures and practice. Orthographic, isometric and oblique projections and intersections. Short Courses in Clay Working and Industrial Arts, first year; Short Course in Mining, second year, second term, *Th., 1-4, F., 1-3.* Prerequisite, Drawing 2 or 32. MR. ROGERS.

39. DRAUGHTING AND BLUE-PRINTING. Three credit hours. Practice and occasional lectures. Short Courses in Clay Working and Industrial Arts, first year; Short Course in Mining and Course in Ceramics, second year, third term, *Th., F., 1-4.* Prerequisite, Drawing 33 or 38. MR. ROGERS.

40. CLAY MODELING. Two credit hours. Modeling in clay, ornamental forms from plaster casts, photographs and nature. Course in Architecture, third year, second term, *M., Tu., 1-3, or Tu., 1-5.* Prerequisite, Drawing 26. ASSISTANT PROFESSOR LEWIS.

41. CLAY MODELING. Two credit hours. Modeling in clay and wax from photographs, nature, and original designs. Casts made in plaster and gelatine molds. Course in Architecture, third year, third term, *M., Tu., 1-3., or Tu., 1-5.* Prerequisite, Drawing 40. ASSISTANT PROFESSOR LEWIS.

AMERICAN HISTORY AND POLITICAL SCIENCE

Office, University Hall, Room 207.

PROFESSOR KNIGHT, ASSISTANT PROFESSORS TUTTLE AND SPENCER.

HISTORY

1. POLITICAL HISTORY OF THE UNITED STATES. Three credit hours. Text-books and prescribed reading. Thwaites's The Colonies, Hart's Formation of the Union; Wilson's Division and Re-Union. Course in Manual Training, third year, first, second and third terms, *M., W., F., 8 or 9.*

POLITICAL SCIENCE

1. POLITICAL INSTITUTIONS OF THE UNITED STATES. Three credit hours. Lectures and recitations. A study of the origin and nature of the political institutions of the United States, and an analysis of the form and powers of the government. Course in Manual Training, fourth year, first term, *M., W., F., 9.* Prerequisite, American History 1.

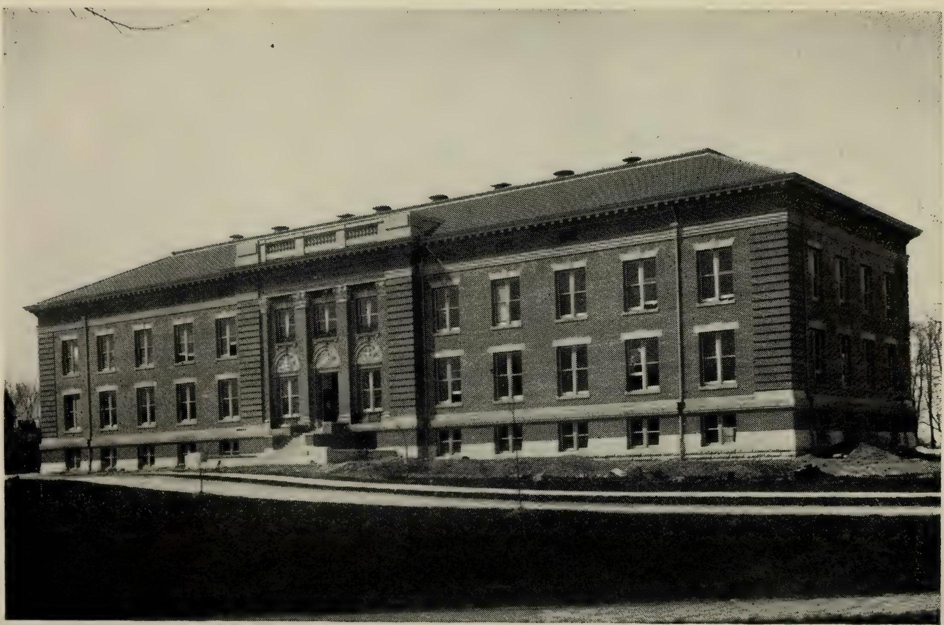
ASTRONOMY

Office, Emerson McMillin Observatory.

PROFESSOR H. C. LORD, MR. SMITH, MR. MAAG.

The Observatory was founded in 1895 through the generosity of Mr. Emerson McMillin. The building and equip-

THE
[illegible] COLLEGE
LIBRARY



CHEMICAL HALL.

ment are designed primarily for the purpose of instruction. The aim of the teaching is to give a mastery of the fundamental principles rather than to accumulate a mass of half-understood measurements. Ten students can work each clear night under the constant supervision of the instructor, the inconvenience of open air observations being reduced to a minimum.

4. Astronomy, Geodesy, and Least Squares. Three credit hours. Lectures on practical astronomy, supplemented by practice with the instruments of the Emerson McMillin Observatory. Courses in Civil Engineering, third year, first term. Lectures *M., W., F., 11.* Laboratory hours arranged with the students individually. Prerequisite, Mathematics 43 and Physics 2.

5. Continuation of 4. Three credit hours. Course in Civil Engineering, third year, second term. Lectures *M., W., F., 11.* Laboratory hours arranged with the students individually.

6. Continuation of 5. Laboratory work. Four credit hours. Course in Civil Engineering, third year, third term. Hours arranged with the students individually.

CHEMISTRY

Office, Chemical Hall.

Professor McPherson, Emeritus Professor Norton, Associate Professor Henderson, Associate Professor Foulk, Assistant Professor Evans, Miss Andrews, Mr. Vogt, Mr. Knote.

The laboratories of the department accommodate about one thousand students. Each laboratory is equipped with all the necessary conveniences—water, gas, electric lights, distilled water piped from a large still in the attic, steam ovens, automatic air blasts, suction pumps, etc. The department is liberally supplied with the best apparatus and materials for both lecture room and laboratory work. Each student has his own desk with drawers and locker. All supplies are procured from the chemical store-room, which has always on hand a complete stock of all necessary materials.

3. Elementary Chemistry. Five credit hours. One lecture, one quiz and six hours laboratory work weekly. This is an elementary course arranged for short course students. Short Course

in Clay-working, first year; Short Course in Mining, second year; first and second terms. Lecture *M., 10,* quiz, *W., 8,* laboratory, *M., Tu., 1-4.* ASSISTANT PROFESSOR EVANS AND DEPARTMENT FELLOWS.

7. ELEMENTARY CHEMISTRY. INORGANIC. Five credit hours. One lecture, one quiz, and six hours laboratory work weekly. Laboratory work; first term, experiments upon the non-metals; second term, experiments upon the metals. All four-year courses, first year, first and second terms, lecture, *M., 8 or 3;* quiz, *F., 9, 10, 1, or 3;* laboratory, *M., Tu., 9-12; Th., F., 9-12, Th., F., 1-4, or W., 8-10, S., 8-12.* PROFESSOR MCPHERSON, ASSISTANT PROFESSOR EVANS, MISS ANDREWS, MR. VOGT, MR. KNOTE AND DEPARTMENT FELLOWS.

8. ORGANIC CHEMISTRY. Five credit hours. One lecture, one quiz, six hours laboratory work weekly. Course in Chemical Engineering, third year, first term, *Tu., Th., 8; M., Tu., 1-4.* Prerequisite, Chemistry 20 and 21. PROFESSOR MCPHERSON.

9. ORGANIC CHEMISTRY. Five credit hours. Course in Chemical Engineering, third year, second term, *Tu., Th., 8; W., F., 1-4.* Prerequisite, Chemistry 8. Option, third term, *Tu., Th., 8; M., F., 1-4.* PROFESSOR MCPHERSON.

12. QUALITATIVE ANALYSIS. Four credit hours. One recitation and six hours laboratory work weekly. All four-year courses, first year, third term. For hours, see Course 7, omitting lecture. Prerequisite, Chemistry, 7.

12a. QUALITATIVE ANALYSIS. Five credit hours. Two recitations and six hours laboratory work weekly. Course in Clay-working, first year, third term, *M., F., 10; M., Tu., 1-4.* Prerequisite, Chemistry 3.

15. SANITARY CHEMISTRY. Four credit hours. Two lectures and four hours laboratory work weekly. A study of the most important chemical methods for the analysis of water. Course in Chemical Engineering, fourth year, third term, *Tu., Th., 10, F., 1-5.* Prerequisite, Chemistry 20. ASSOCIATE PROFESSOR FOULK.

20. QUANTITATIVE ANALYSIS. Four credit hours. One lecture and six hours laboratory work weekly. Principles of gravimetric and volumetric analysis. Course in Chemical Engineering, second year. Course in Manual Training, third year, option. First, second, and third terms, *M., Tu., 1-4, W., 1-3.* Prerequisite, Chemistry 12. Concurrent, Chemistry 21 and 40. ASSOCIATE PROFESSOR FOULK.

21. ADVANCED GENERAL CHEMISTRY. Two credit hours. Two lectures weekly. A thorough study of the principles of general inorganic chemistry, paying special attention to chemical theory. Course in Chemical Engineering, second year: Option, Course in Manual Training, third year, first, second, and third terms, *Tu., Th., 9.* Prerequisite, Chemistry 12. Concurrent, Chemistry 20. ASSOCIATE PROFESSOR HENDERSON.

30. PHYSICAL CHEMISTRY. Three credit hours. Three lectures weekly. A general study of the principles of Chemistry. Course in Chemical Engineering, fourth year, second and third terms, *M., W., F., 8.* Prerequisite, Chemistry 9, 20, and 21. ASSOCIATE PROFESSOR HENDERSON.

32. INDUSTRIAL CHEMISTRY. Four credit hours. Two lectures and four hours laboratory work weekly. Course in Chemical Engineering, fourth year, first and second terms, *Tu., Th., 8, W., Th., 1-3.* Prerequisite, Chemistry 9, 20, and 21. ASSOCIATE PROFESSOR HENDERSON.

35. RARE ELEMENTS. Three credit hours. Three lectures weekly. A study of those elements usually passed by with brief comment in general courses. It is of considerable practical value to students of metallurgy, since many of the rarer elements are now frequently met with in the metallurgical industries and the analyst must be familiar with their properties. Option, Course in Chemical Engineering, fourth year, first term, *M., W., F., 8.* Prerequisite, Chemistry 20 and 21. ASSOCIATE PROFESSOR HENDERSON.

40. STOICHIOMETRY. One credit hour. Drill in the solution of chemical problems. Course in Chemical Engineering, second year, second and third terms, *Th., 11.* Prerequisite, Chemistry 12. ASSOCIATE PROFESSOR FOULK.

CIVIL ENGINEERING

Office, Brown Hall, Room, 33.

PROFESSOR SHERMAN, PROFESSOR ENO, ASSOCIATE PROFESSOR MORRIS, ASSISTANT PROFESSOR SCHLAFLY, MR. CHAMBERLIN, MR. WARD.

The department is housed in Brown Hall. For drafting, three spacious and well-lighted drawing rooms are provided for the work of the second, third, and fourth-year students respectively. In each room is a collection of working drawings, prints, maps, etc., gathered from practicing engineers, and arranged in suitable file-cases for the ready consultation of the students. A large blue-print room on the ground floor is equipped with electrical blue-print apparatus, in addition to the ordinary sunlight frames.

For field work the instruments are one high-grade transit, ten other transits fitted for various kinds of surveying, six leveling instruments, solar compass, two solar attachments, two high-grade aneroid barometers, two drainage levels, surveying camera, rods, chains, tapes, hand-levels, etc. Two current meters with accessories, and a rating course 175 feet long in the rear of the building furnish facilities for carrying on hydrographic work.

The cement-testing laboratory is fitted with necessary appliances for making the ordinary tests. It contains a Fairbanks testing machine, briquette molds, sieves, apparatus for making hot tests, etc., and machine for testing plain and reinforced concrete beams.

The department also owns a complete outfit for carrying on the work of summer surveying in camp. Summer camp for 1903 was pitched in the heart of the mountains of southeastern Kentucky, for the survey of an extensive tract of coal lands. Summer camp for 1905 was pitched in Yellowstone National Park, where the classes were engaged in surveying the road system.

1. LAND SURVEYING. Six credit hours. Recitations and field work. Johnson's Theory and Practice of Surveying. Course in Civil Engineering, second year, first term, *M., Tu., W., Th., F., 11 or 1.* Field work, *M., Tu., W., or F., 2-4, or S., 8-10.* Prerequisite, Mathematics 14 or 32. PROFESSOR SHERMAN, PROFESSOR ENO, ASSISTANT PROFESSOR SCHLAFLY, MR. CHAMBERLIN, MR. WARD.

2. RAILROAD SURVEYING. Six credit hours. Recitations and field work. Searles' Field Engineering and Crandall's Transition Curve. Course in Civil Engineering, second year, third term, *M., Tu., W., Th., F., 11 or 1.* Field work, *M., Tu., W. or F., 2-4, or S., 8-10.* Prerequisite, Civil Engineering 1. PROFESSOR SHERMAN,

CLASS IN RAILROAD SURVEYING.

PROFESSOR ENO, ASSISTANT PROFESSOR SCHLAFLY, MR. CHAMBERLIN, MR. WARD.

3. TOPOGRAPHIC SURVEYING. Four credit hours. Lectures, field work, and drawing. Johnson's Surveying used for reference. Course in Civil Engineering, third year, first term, *M., F., 10, Tu., Th., 2-5; or Tu., Th., 10, M. and W. or F., 2-5.* Prerequisite, Civil Engineering 2 and 22. ASSISTANT PROFESSOR SCHLAFLY, MR. CHAMBERLIN.

4. TOPOGRAPHIC DRAWING. Four credit hours. Platting, pen and tinted work. Reed's Topographic Drawing and Sketching. Course in Civil Engineering, second year, second term, *M., Tu., 1-4, W., 1-3; or Th., F., 2-4, S., 8-12.* Prerequisite, Drawing 26 and 32. PROFESSOR SHERMAN, PROFESSOR ENO.

6. STEREOTOMY. Four credit hours. Recitations, lectures and drawing. Warren's Stereotomy. Courses in Architecture and Civil Engineering, third year, second term, *M., F., 10, S., 8-12; or Tu., Th., 10, S., 8-12.* Prerequisite, Drawing 36. PROFESSOR SHERMAN, ASSISTANT PROFESSOR SCHLAFLY, MR. CHAMBERLIN.

7. BRIDGE STRESSES. Five credit hours. Recitations and lectures. Heller's Stresses in Structures. Course in Civil Engineering, third year, third term, *M., Tu., W., Th., F., 8 or 9.* Prerequisite, Mathematics 72. ASSOCIATE PROFESSOR MORRIS.

8. BRIDGE DESIGNING. Five credit hours. Lectures and drawings. Heller's Notes and Johnson's Modern Framed Structures used for reference. Course in Civil Engineering, fourth year, first term, *M., Tu., W., Th., F., 8.* Prerequisite, Civil Engineering 7. ASSOCIATE PROFESSOR MORRIS.

10. SANITARY ENGINEERING. Five credit hours. Recitations and lectures. Folwell's Sewerage. Course in Civil Engineering, fourth year, third term, *M., Tu., W., Th., F., 9.* Prerequisite, Civil Engineering 15. PROFESSOR ENO.

14. CIVIL ENGINEERING LABORATORY. Cement testing. Two credit hours. Course in Civil Engineering, fourth year, second term, *M., 1-4, Tu., 1; or Tu., 1-4, W., 1.* Prerequisite, Civil Engineering 15. PROFESSOR ENO, MR. WARD.

15. MASONRY CONSTRUCTION. Five credit hours. Recitations and lectures. Baker's Masonry Construction. Courses in Architecture and Civil Engineering, fourth year, first term, *M., Tu., W., Th., F., 9.* Prerequisite, Mathematics 72. PROFESSOR SHERMAN.

16. HIGHWAYS. Five credit hours. Recitations and lectures. Baker's Roads and Pavements. Course in Civil Engineering, third year, first term, *M., T., W., Th., F., 8 or 9.* Prerequisite Civil Engineering 2. PROFESSOR ENO.

17. RAILWAY LOCATION. Five credit hours. Recitations and lectures. Wellington's Economic Theory of Railway Location. Option, course in Civil Engineering, fourth year, second term, *M., Tu., W., Th., F., 9.* Prerequisite, Civil Engineering 15. PROFESSOR SHERMAN.

18. WATER SUPPLY. Five credit hours. Recitations and lectures. Turneaure and Russell's Public Water Supplies. Course in Civil Engineering, fourth year, third term, *M., Tu., W., Th., F., 8.* Prerequisite, Civil Engineering 15. PROFESSOR ENO.

19. TRUSSES. Five credit hours. Lectures and drawings. Courses in Architecture, Mining, and Mechanical Engineering, third year, third term, *M., Tu., Th., F., 10, W., 2; or M., Tu., W., Th., F., 11.* Prerequisite, Mathematics 72. ASSOCIATE PROFESSOR MORRIS.

21. SURVEYING. Three credit hours. Recitations, lectures and field work. Courses in Architecture and Industrial Arts, fourth year, third term, *M., W., F., 9.* Prerequisite, Drawing 32 and Mathematics 14 or 32. PROFESSOR SHERMAN, MR. CHAMBERLIN, MR. WARD.

22. SUMMER COURSE IN FIELD WORK. The students are taken into camp in a rough, broken country and given a thorough drill in land and elementary railroad surveying. The course begins the Friday before Commencement Day, and continues four weeks of six days per week, ten hours per day. The work of the student and discipline of the camp is in the hands of competent instructors. At conclusion of second year of Course in Civil Engineering. Prerequisite, Civil Engineering 2 and 4. PROFESSOR SHERMAN, PROFESSOR ENO, ASSISTANT PROFESSOR SCHLAFLY, MR. CHAMBERLIN, MR. WARD.

23. SUMMER COURSE IN FIELD WORK. Similar to Course 22. Students work on advanced railroad surveying and topographical surveying. At conclusion of third year of Course in Civil Engineering. Prerequisite, Civil Engineering 3, 22 and 24.

24. DRAWING OF ENGINEERING STRUCTURES. Five credit hours. Course in Civil Engineering, third year, second term, *M., Tu., W.,*

1-4; or W., Th., F., 1-4. Prerequisite, Drawing 35 and Mathematics 71. ASSISTANT PROFESSOR SCHLAFLY, MR. CHAMBERLIN.

25. ADVANCED BRIDGE WORK. Five credit hours. Draw-spans, continuous girders, steel arches, etc. Option, Course in Civil Engineering, fourth year, second term, *M., Tu., W., Th., F., 8.* Prerequisite, Civil Engineering 8. ASSOCIATE PROFESSOR MORRIS.

27. TIMBER AND MASONRY. Three credit hours. Lectures and recitations. Use of stone, brick, lime, cement, timber, etc., in engineering structures. Courses in Industrial Arts and Mechanical Engineering, third year, last three-fifths of second term, *M., Tu., W., Th., F., 9.* Concurrent, Industrial Arts 4 or Mathematics 72. ASSISTANT PROFESSOR SCHLAFLY.

28. STEEL CONSTRUCTION. Five credit hours. Steel skeleton construction for tall buildings. Course in Architecture, fourth year, second term, *M., Tu., W., Th., F., 9.* Prerequisite, Civil Engineering 19. ASSOCIATE PROFESSOR MORRIS.

29. CEMENT TESTING. Three credit hours. Course in Architecture, fourth year, second term, *Tu., W., 1-4.* Prerequisite, Civil Engineering 15. PROFESSOR ENO, MR. WARD.

CLAY WORKING AND CERAMICS

Office, School of Mines Building.

PROFESSOR ORTON, ASSISTANT PROFESSOR BLEININGER, MR. RIDDLE.

The equipment of the department is exceptional; it was provided by special act of the State Legislature, and has been extended by many valuable gifts and purchases. It is situated in the new School of Mines building, which has just been built and equipped at a cost of about $110,000. The floor space occupied by the Ceramic Department is about 14,000 square feet. The equipment comprises a chemical laboratory, a physical testing room, a stock and preparation room, a pottery laboratory, a machine room, chiefly devoted to grinding materials and manufacturing and testing structural materials, bricks, etc., a kiln room, two lecture rooms, a museum of ceramic materials and products, and library facilities unusually complete on the technical side.

The department is also much assisted by the co-operation of clay and cement manufacturers who have afforded opportunities for experimental work in their plants.

1. CERAMIC CHEMISTRY. Five credit hours. Quantitative analysis of salts, limestone, and other simple minerals. Course in Ceramics and Short Course in Clay-working, second year, first term, *M., Tu., W., 1-4.* Prerequisite, Chemistry 12 or 12a. ASSISTANT PROFESSOR BLEININGER.

2. CONTINUATION OF 1. Five credit hours. Quantitative analysis of clays and similar minerals; first, samples of known composition; later, unknown materials. Course in Ceramics and Short Course in Clay-working, second year, second term, *M., Tu., W., 1-4.* ASSISTANT PROFESSOR BLEININGER.

3. CONTINUATION OF 2. Five credit hours. Completion of the ultimate analysis of clays; the proximate or "Rational" analysis of clays and pottery bodies. Course in Ceramics, second year, third term, *M., Tu., W., 1-4.* ASSISTANT PROFESSOR BLEININGER.

4. CLAY MANUFACTURE. Five credit hours. The origin, composition, and properties of clays and other minerals employed in the clay, glass, and cement industries. Course in Ceramics, third year, first term; Short Course in Clay-working, second year, first term, *M., Tu., W., Th., F., 8.* Concurrent, Ceramics 1. PROFESSOR ORTON.

5. CONTINUATION OF 4. Five credit hours. General principles of the manufacture of clay wares, including the selection and winning of the materials, their preparation, manufacture and drying. Course in Ceramics, third year; Short Course in Clay-working, second year, second term, *M., Tu., W., Th., F., 8.* PROFESSOR ORTON.

6. CONTINUATION OF 5. Five credit hours. Burning and decoration of claywares, including the preparation of coloring materials, glazes, etc. Course in Ceramics, third year; Short Course in Clay-working, second year, third term, *M., Tu., W., Th., F., 8.* PROFESSOR ORTON.

7. CERAMIC CHEMISTRY. Five credit hours. The analysis of glasses and glazes, with special attention to the use of hydrofluoric acid in silicate analysis, and to the determination of the coloring oxides and boracic acid. Course in Ceramics, third year, third term,

M., Tu., W., 1-4. Prerequisite, Ceramics 3. ASSISTANT PROFESSOR BLEININGER.

9. LABORATORY WORK IN CERAMICS. Five credit hours. Practice in clay testing and measurement of the physical properties of clays; the production of bodies made from single clays, from the blending of two or more natural clays, and from clays and minerals other than clays. In each case the bodies made will be burnt and tested. Course in Ceramics, fourth year, first term, *W., Th., F., 1-4.* Prerequisite, Ceramics 3 and 6. PROFESSOR ORTON, MR. RIDDLE.

10. CONTINUATION OF 9. Five credit hours. The production of glasses and glazes, beginning with the soft raw-lead glazes, the fritted lead-boracic-acid glazes, and the hard-fire leadless porcelain glazes. In each case the glazes will be made for use on some definite body. Alternative with Ceramics 12. Course in Ceramics, fourth year, second term, *W., Th., F., 1-4.* PROFESSOR ORTON, MR. RIDDLE.

11. CONTINUATION OF 10. Five credit hours. Practice in the use of the coloring and opacifying oxides in glazes, and in the production of colors for the decoration of pottery and of body stains. Alternative with Ceramics 18. Course in Ceramics, fourth year, third term, *M., F., 8-12, F., 1-3.* PROFESSOR ORTON, MR. RIDDLE.

12. CEMENT MANUFACTURE. Five credit hours. Lectures. The theory of hydraulicity, the compounding, manufacture, and testing of natural and Portland cements and hydraulic silicates. Alternative with Ceramics 10. Course in Ceramics, fourth year, second term, *M., Tu., W., Th., F., 9.* Prerequisite, Ceramics 3 and 6. ASSISTANT PROFESSOR BLEININGER.

15. THESIS.

16. GENERAL PRINCIPLES OF APPLIED CERAMICS. Five credit hours. Chemical technology of the clay, glass, and cement industries. Course in Chemical Engineering, fourth year, third term, *M., Tu., W., Th., F., 9.* Prerequisite, Chemistry 20. PROFESSOR ORTON.

18. CEMENT MANUFACTURE. Five credit hours. Laboratory. Training in the analysis of cement materials by the methods in technical use; in the preparation of minerals for cement; in the burning of cement; in the testing of the products, and in the investigation of the general problems of the cement manufacturer. Alternative with Ceramics 11. Course in Ceramics, fourth year,

third term, *M., F., 8-12, F., 1-3.* Prerequisite, Ceramics 12. ASSISTANT PROFESSOR BLEININGER.

19. STOICHIOMETRY. Five credit hours. Calculation of bodies and glazes and the combustion of the fuel necessary for work in driers and kilns. Short course in Clay-working, second year, third term, *M., Tu., W., Th., F., 11.* Prerequisite, Ceramics 1 and 2. ASSISTANT PROFESSOR BLEININGER, MR. RIDDLE.

20. LABORATORY WORK IN CERAMICS. Two credit hours. Testing of clays and minerals employed in clay manufacture. Short course in Clay-working, second year, first term, *Th., F., 1-4.* Prerequisite, Chemistry 12a. Concurrent, Ceramics 1. PROFESSOR ORTON, MR. RIDDLE.

21. LABORATORY WORK IN CERAMICS. Two credit hours. Compounding of artificial clay bodies and the blending of natural clays. Short course in Clay-working, second year, second term, *Th., F., 1-4.* Prerequisite, Ceramics 20. PROFESSOR ORTON, MR. RIDDLE.

22. PHYSICAL CHEMISTRY. Three credit hours. The elementary conceptions of physical chemistry with special reference to the silicate industries. Course in Ceramics, fourth year, second term, *M., Tu., 1-4.* Prerequisite, Ceramics 6 and 7. ASSISTANT PROFESSOR BLEININGER.

23. LABORATORY WORK IN CERAMICS. Seven credit hours. The production of glazes of the types commonly used in the pottery and allied industries. Practice will be given in fitting glazes to some definite body. Short course in Clay-working, second year, third term, *M., Tu., W., Th., F., 1-4.* Prerequisite, Ceramics 2 and PROFESSOR ORTON, MR. RIDDLE.

DRAWING

(See Architecture and Drawing, page 52.)

ECONOMICS AND SOCIOLOGY

Office, Room 211, University Hall.

PROFESSOR HAGERTY, PRESIDENT THOMPSON, ASSOCIATE PROFESSOR HAMMOND, ASSISTANT PROFESSOR McKENZIE.

ECONOMICS

30. INDUSTRIAL AND SOCIAL HISTORY OF ENGLAND. Three credit hours. First term. A general view of the evolution of society;

the influence of the invasion on England; the rise and development of the memorial and gild systems; the formation and influence of trading companies; the labor and poor laws; the development of capitalistic enterprises, and the economic and social legislation especially of the 19th century. Text-book, lectures, and assigned readings. Course in Industrial Arts, second year, first term, *M., W., F., 8.* Other Sections, *9 and 2.* ASSOCIATE PROFESSOR McKENZIE.

31. INDUSTRIAL AND SOCIAL HISTORY OF THE UNITED STATES. Three credit hours. Second term. A general view of the industrial and social conditions in the colonies; the westward expansion and settlement, and the industrial and social problems involved. The national land policy and the gradual development of internal improvements, etc. Text-book, lectures, and assigned readings. Course in Industrial Arts, second year, second term, *M., W., F., 8.* Other Sections, *M., F., W., 9 and 2.* ASSISTANT PROFESSOR McKENZIE.

32. COMMERCIAL AND ECONOMIC GEOGRAPHY. Three credit hours. Third term. A brief survey of the industrial resources, transportation systems and commercial conditions of the different countries with the purpose of showing the part which they play in the world's trade. Text-book, lectures and assigned readings. Course in Industrial Arts, second year, third term, *M., W., F., 8.* Other Sections, *M., W., F., 9 and 2.* ASSISTANT PROFESSOR McKENZIE.

33. ELEMENTS OF POLITICAL ECONOMY. Three credit hours. A careful study of the laws of production, exchange, distribution, and consumption of wealth; combined with an analysis of the industrial actions of men as regards land, labor, capital, money, credit, rent, interest, wages, etc. Text-book, lectures, and individual investigations. Not open to first-year students. Course in Industrial Arts, third year, three terms, *M., W., F., 8.* Other Sections, *M., W., F., 9 and 11.* PROFESSOR HAGERTY, ASSOCIATE PROFESSOR HAMMOND.

37. INDUSTRIAL ORGANIZATION AND MANAGEMENT. Three credit hours. The various forms of business undertakings and the methods by which capital and labor are secured and organized for productive purposes are here considered. Especial attention is given to industrial corporations, their internal organization, securities, receiverships, and reorganization. Course in Indus-

trial Arts, fourth year, first term, *M., W., F., 9.* Prerequisite, Economics, 33. ASSOCIATE PROFESSOR HAMMOND.

38. INDUSTRIAL CONCENTRATION AND MONOPOLY. Three credit hours. A discussion of the forces and tendencies which lead to a large scale production. The causes and forms of industrial consolidations. Trust promotion, financiering, and management. The tendency toward monopoly and monopolistic methods. The relation of the state to the monopoly problem and proposed methods of public control of monopolies. Course in Industrial Arts, fourth year, second term, *M., W., F., 9.* Prerequisite, Economics 37. ASSOCIATE PROFESSOR HAMMOND.

39. LABOR ORGANIZATIONS AND EMPLOYERS' ASSOCIATIONS. Three credit hours. A study of methods by which laborers and employers organize for the purpose of endeavoring to control the labor market. The methods of collective bargaining, and the establishment of trade agreements. Course in Industrial Arts, fourth year, third term, *M., W., F., 9.* Prerequisite, Economics 38. ASSOCIATE PROFESSOR HAMMOND.

EDUCATION

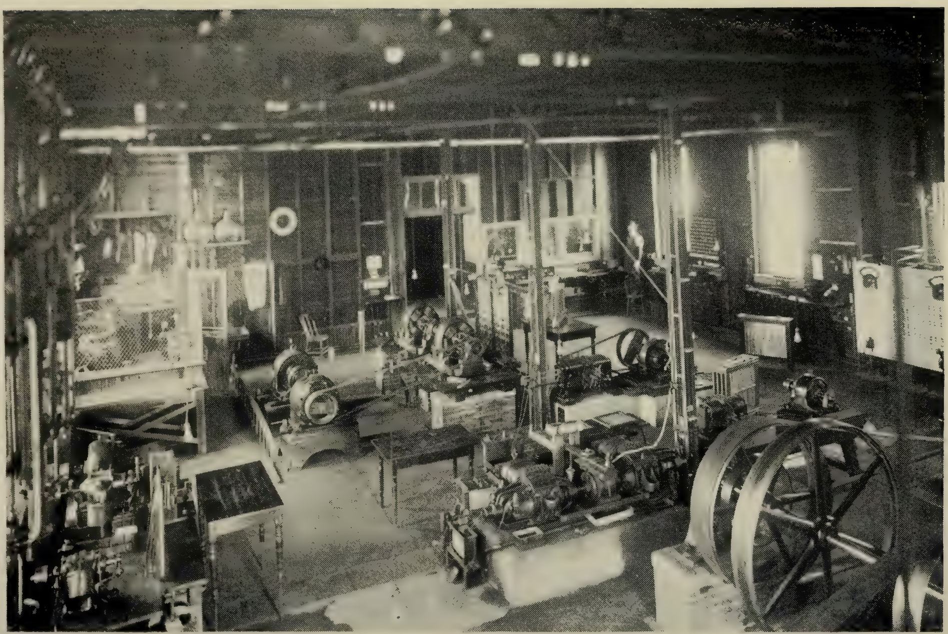
Office, University Hall, Room 407.

PROFESSOR MAJOR, ASSISTANT PROFESSOR HAINES.

1. EDUCATIONAL PSYCHOLOGY. Three credit hours. A thorough study of laws and principles selected from psychological literature bearing on educational theory and practice. The function of psychology in determining the selection and arrangement of school studies and its bearing on class room procedure. James' Talks on Psychology supplemented by references to standard texts and to periodicals on psychology and education. Course in Manual Training, second year, first, second, and third terms, *M., W., F., 11.*

5. SCIENCE AND EDUCATION. Three credit hours. The foundations of educational theory; especially intended for the student who expects to deal with the larger problems of education which confront superintendent or principal. Lectures, required readings and reports. Course in Manual Training, fourth year, first, second, and third terms, *M., W., F., 11.*

THE
JOHN CRERAR
LIBRARY



ELECTRICAL LABORATORY.

ELECTRICAL ENGINEERING

Office, Electrical Building, Room 8.

PROFESSOR CALDWELL, ASSOCIATE PROFESSOR ANDEREGG, ASSISTANT PROFESSOR COGGESHALL.

This department has excellent facilities for practical experimental work with dynamo machinery and other electrical apparatus. The dynamo equipment consists of twenty-three machines of various makes and sizes from 40-H. P. down, aggregating over 250 horsepower. These include 110 and 500 volt direct and alternating current generators, railway and stationary motors, polyphase motors, three rotary converters specially designed for experimental work, and a unipolar dynamo. There are also a number of transformers of different makes, including one for welding, one for very high voltage and six of special design for testing. Arc lamps of different styles, a storage battery, condensers, resistances, circuit breakers and apparatus for magnetic testing, illumination testing and photometric work also form part of the equipment. The measuring instruments include a standard Weston voltmeter with standard resistances and cells, besides over forty other voltmeters and ammeters, mostly Weston's, and seven wattmeters, There is a telephone laboratory with apparatus for comparative tests, a variety of transmitters and receivers, and material illustrative of switch-board practice.

Power for running the dynamo laboratory is supplied from the University Power Plant by five induction motors and two synchronous motors or converters. There is also a well-selected and growing collection of photographs, blue-prints and material illustrative of electrical manufacture. The library of the department is especially valuable on account of the completeness of its sets of periodicals and transactions. The University Power Plant is of great value as illustrative of a model installation.

6. ELECTRICAL ENGINEERING. Two credit hours. Lectures on direct and alternating circuits, dynamo machinery, transformers, accumulators and their applications. Courses in Civil, Mechanical, and Mine Engineering, Industrial Arts and Manual Training, fourth year, first and second terms; Course in Chemical Engineering, fourth year, first term, *M., Th., 10.* Prerequisite, Physics 2. ASSOCIATE PROFESSOR ANDEREGG.

7. ELECTRICAL ENGINEERING. Two credit hours. Laboratory work on the subjects treated in 6. Fourth year. ASSOCIATE PROFESSOR ANDEREGG, ASSISTANT PROFESSOR COGGESHALL.

FIRST TERM.

M., 1-5. Course in Chemical Engineering.
W., 1-5. Course in Industrial Arts.
S., 8-12. Course in Manual Training.
W., 1-5 or S., 8-12. Course in Mechanical Engineering.
M., 1-5. Course in Mine Engineering.

SECOND TERM.

M. or W., 1-5. Course in Civil Engineering.
Th., 1-5. Course in Industrial Arts.
Th., 1-5. Course in Manual Training.
F., 1-5 or S., 8-12. Course in Mechanical Engineering.
M., 1-5 or S., 8-12. Course in Mine Engineering.

8. DIRECT CURRENT DYNAMO MACHINERY. Four credit hours. Generators and motors, their theory, construction, and operation. Lectures, recitations and problems. Course in Electrical Engineering, third year, second term, *M., Tu., Th., F., 9.* Prerequisite, Physics 4, Mathematics 43. Concurrent, Physics 6. ASSOCIATE PROFESSOR ANDEREGG.

9. ELEMENTARY DYNAMO LABORATORY. Four credit hours. Handling and testing of circuits, generators, motors, etc. Course in Electrical Engineering, third year, third term, *W., Th., 1-5; or F., 1-5, S., 8-12.* Prerequisite, Electrical Engineering. ASSOCIATE PROFESSOR ANDEREGG, ASSISTANT PROFESSOR COGGESHALL.

11. ADVANCED DYNAMO LABORATORY. Three credit hours. Alternating current, railway and telephone apparatus, accumulators, illumination, etc. Course in Electrical Engineering, fourth year, first and second terms, *Tu. or Th., 10-5;* third term, *M. or Tu., 10-5.* Prerequisite, Electrical Engineering 15. Concurrent, 16 and 17. PROFESSOR CALDWELL, ASSISTANT PROFESSOR COGGESHALL.

15. ALTERNATING CURRENT CIRCUITS AND MACHINERY. Two credit hours. Systems, generators, and transformers. Course in Electrical Engineering, third year, third term, *M., Th., 10.* Concurrent, Electrical Engineering 9. PROFESSOR CALDWELL.

16. **Continuation of 15. Three credit hours. Synchronous** and induction motors, etc. Course in Electrical Engineering, fourth year, first term, *M., W., F., 11.* Concurrent, Electrical Engineering 11. PROFESSOR CALDWELL.

17. **Continuation of 16. Two credit hours. Course in Electri**cal Engineering, fourth year, second term, *M., W., 8.* Concurrent, Electrical Engineering 11. PROFESSOR CALDWELL.

18. ELECTRICAL DESIGN. Three credit hours. Direct and alternating current generators, transformers, distribution, wiring of buildings, etc. Course in Electrical Engineering, fourth year, second term, *F., 1-4, S., 8-11.* Prerequisite, Drawing 5. Concurrent, Industrial Arts 9. ASSISTANT PROFESSOR COGGESHALL.

19. **Continuation of 18. Four credit hours. Course in Elec**trical Engineering, fourth year, third term, *W., Th., 1-5.* ASSISTANT PROFESSOR COGGESHALL.

20. INSPECTION TRIP TO THE EAST. Includes Pittsburg, Buffalo, Niagara, Cleveland, and possibly other places; is taken at the end of the winter term and occupies six days. The entire expense need not exceed $30.00. A satisfactory written report upon the work of the trip is required. Given only in the even years. Required in the Course in Electrical Engineering, third or fourth year.

21. INSPECTION TRIP TO THE WEST. Includes Chicago, Milwaukee, Cincinnati, and possibly other places; is taken at the end of the winter term, and occupies six days. The entire expense need not exceed $30.00. A satisfactory written report on the work of the trip is required. Given only in the odd years. Required in the Course in Electrical Engineering, fourth or third year.

22. WRITTEN REPORT. Course of assigned reading upon processes of manufacture and power plants may be reported upon by third and fourth year students in the Course in Electrical Engineering as a substitute for 20, on presentation of reasons satisfactory to the head of the department.

23. SIMILAR TO 22. A substitute for 21.

24. APPLICATIONS OF ELECTRICITY. Two credit hours. Brief treatment of the elements of illumination, railway work, telephone,

storage batteries, mining, etc. Course in Electrical Engineering, fourth year, second term, *Tu., Th., 8.* Prerequisite, Electrical Engineering 8. PROFESSOR CALDWELL, ASSOCIATE PROFESSOR ANDEREGG, ASSISTANT PROFESSOR COGGESHALL.

25. ELECTRICAL TRANSMISSION AND DISTRIBUTION. Two credit hours. Systems, apparatus and operation. Course in Electrical Engineering, fourth year, third term, *Tu., Th., 8.* Prerequisite, Electrical Engineering 8. PROFESSOR CALDWELL.

26. ELECTRIC RAILWAYS. Three credit hours. Including principles of general design, transmission and distribution systems, cars, motors, and operation. Course in Electrical Engineering, fourth year, third term, *M., W., F., 8.* Alternative with course 27. Prerequisites, Electrical Engineering 17 and 24. PROFESSOR CALDWELL.

27. TELEPHONY. Three credit hours. Methods of operation. Simple circuits and apparatus. Elements of transmission theory. Course in Electrical Engineering, fourth year, third term, *M., W., F., 8.* Alternative with course 25. Prerequisites, Electrical Engineering 17 and 24. ASSOCIATE PROFESSOR ANDEREGG.

ENGLISH

Office, University Hall, Room 116.

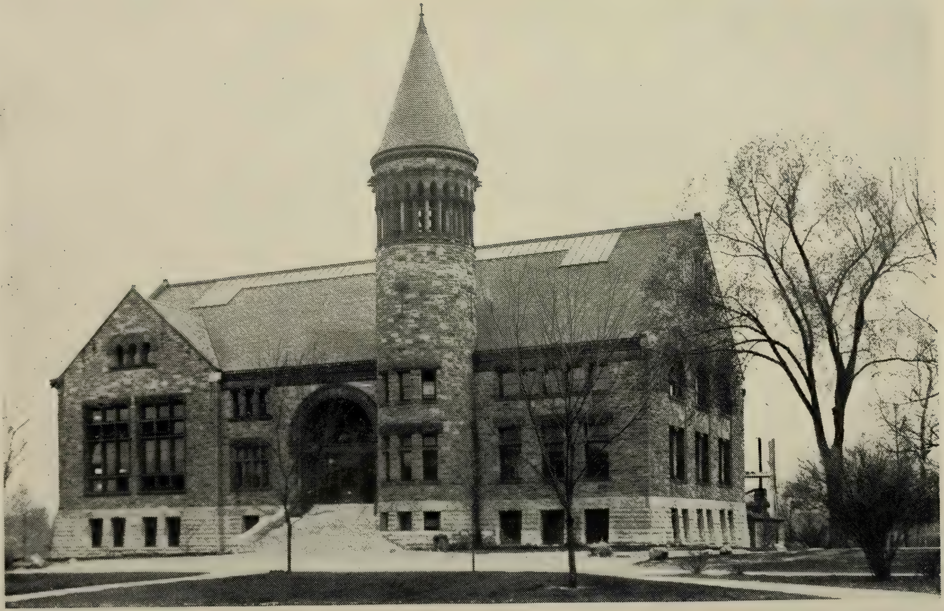
PROFESSOR DENNEY, PROFESSOR BARROWS, ASSOCIATE PROFESSOR TAYLOR, ASSISTANT PROFESSORS GRAVES, MCKNIGHT, DUNCAN, MR. MCKINNEY.

1. PARAGRAPH WRITING AND ANALYSIS OF PROSE. Two credit hours. Writing of short themes, outlining and composition of essays and speeches and the study of illustrative texts for structure and form. All four-year courses, first year, first, second and third terms, *Tu., Th., 8; W., F., 8; or Tu., Th., 9 or 10.*

2. EXPOSITORY WRITING. Two credit hours. Composition and analysis of various types of essays. Courses in Industrial Arts, Manual Training, and Electrical and Mechanical Engineering, second year; Courses in Architecture, Ceramics and Chemical, Civil and Mine Engineering, third year, first term, *M., F., 10; or Tu., Th., 10; or Tu., Th., 11; or W., F., 1.* Prerequisite, English 1.

3. BRIEF-MAKING AND WRITTEN ARGUMENTATION. Two credit hours. Principles of logical analysis, evidence and argumentation, writing briefs of noted speeches, preparation of original briefs with written argumentation. Courses and years as in 2. Second term,

THE
JOHN CRERAR
LIBRARY



ORTON HALL.

M., F., 10; Tu., Th., 10; or Tu., Th., 11. Third term, *M., F., 10; or Tu., Th., 10.* Prerequisite, English 1.

FRENCH

(See Romance Languages and Literatures.)

GEOLOGY

Office, Orton Hall, Room 1.

Professor Prosser, Professor Bownocker, Assistant Professor Hubbard.

By an act of the Legislature, the University has been put in possession of all the collections made by the geological survey, and these have been supplemented by valuable additions of fossils and minerals from various sources. The State collection embraces a very complete representation of every geological formation shown in Ohio. Exceptionally good opportunities exist for work in the lithological and stratigraphical laboratories.

Orton Hall is designed for the permanent accommodation of these large geological collections and for work and instruction in the department of Geology. The building is built of brick and faced with sandstone. Some of the material was contributed by various quarries of the State of Ohio, and almost all of the finer varieties of Ohio building stone are represented in the columns, walls, and ceiling panels of the vestibule.

1. Physiography. Five credit hours. The topographic features of the earth's surface and the agencies producing these. The atmosphere, climate, etc. Oceans, rivers and lakes. Recitations, lectures, map work. Short Course in Mining, first year; Short Course in Industrial Arts, second year, third term, *M., Tu., W., Th., F., 11.* Assistant Professor Hubbard.

2. General Geology. Five credit hours. Structural, dynamical, and historical geology. The lectures are illustrated by maps, specimens, and lantern views. The common rock-forming minerals, rocks and fossils are studied in the laboratory;

while in the field specimens are collected, sections measured, formations identified, and the student given an idea of the method of work pursued by a field geologist. Courses in Architecture, Ceramics, Civil, and Mine Engineering, fourth year, first term. Lectures and recitations, *M., Tu., W., F., 11;* laboratory, *Th.;* field work first half of term, *F.* afternoon *or S.* forenoon, when the *F.* lecture will be omitted. PROFESSOR PROSSER, ASSISTANT PROFESSOR HUBBARD.

4. ELEMENTARY GEOLOGY. Five credit hours. Lithological, dynamical, structural, and historical geology. Recitations, lectures, laboratory work. Short Course in Mining, second year, second term, *M., Tu., W., Th., F., 9.* ASSISTANT PROFESSOR HUBBARD.

6. ECONOMIC GEOLOGY. Three credit hours. The nature of ores, their classification, and origin. The metals of the United States, their distribution, abundance, modes of occurrence, and origin. The non-metals, coal, oil, gas, clay, lime, cement, building stone, etc. In the discussion of the non-metals emphasis will be laid on the products of Ohio. Courses in Ceramics, Civil, and Mine Engineering, fourth year, second term, *M., W., F., 11.* Prerequisite, Geology 2. PROFESSOR BOWNOCKER.

7. PETROGRAPHY. Two credit hours. The igneous, sedimentary and metamorphic rocks—their origin and classification. The object of this course is to give the student a practical acquaintance with rocks. Courses in Ceramics and Mine Engineering, fourth year, second term, *Tu., F., 10.* Concurrent, Geology 6. PROFESSOR BOWNOCKER.

GERMANIC LANGUAGES AND LITERATURES

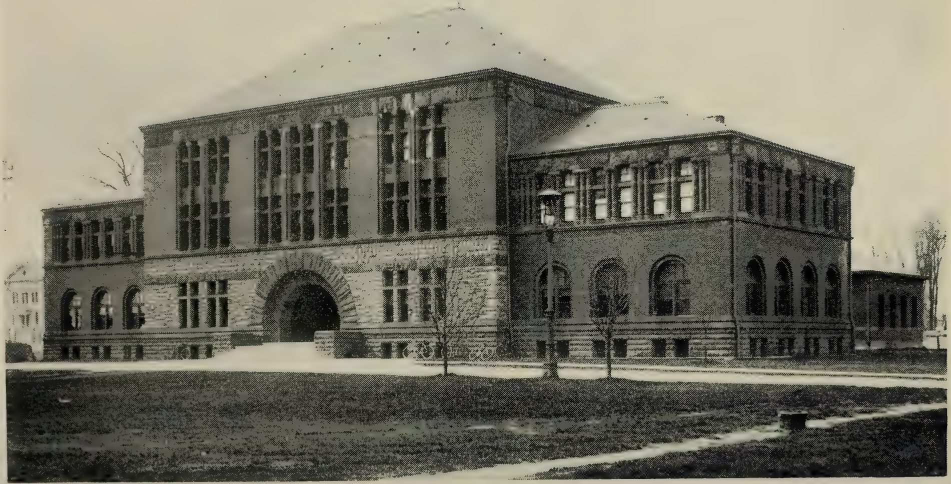
Office, University Hall, Room 317.

PROFESSOR RHOADES, ASSISTANT PROFESSOR VILES, MR. EISENLOHR.

1. ELEMENTARY GERMAN. Four credit hours. Required of all students who offer partial credit in German as their entrance language. Offered as alternative with French 1 and Spanish 1 to all students who enter with full or partial credit in Latin or Greek, or without previous language training. First, second, and third terms. *M., Tu., Th., F., 10 or 11; or Tu., W., Th., F., 2 or 3.*

2. SCIENCE READING. Four credit hours. Required of all students who offer only German as their modern language for entrance. Third term, *M., Tu., W., Th., 8 or 9.* Prerequisite, German 4.

THE
CRERAR
LIBRARY



HAYES HALL.

4. Intermediate German. Four credit hours. Review of Grammar. Reading of descriptive and narrative prose, with prose composition. Required of all students who offer only German as their modern language for entrance. First and second terms, *M., Tu., Th., F., 10 or 11; Tu., W., Th., F., 8 9 or 2.* Prerequisite, German 1.

HISTORY

(See American History and Political Science).

INDUSTRIAL ARTS

Office, Hayes Hall, Room 2.

Professor Sanborn, Assistant Professor Knight, Mr. Renck, and Mr. Crowe.

The shops in Hayes Hall afford excellent facilities for instruction in both the practical details and the underlying principles of carpentry, pattern-making, forging, molding, founding, and machine work.

The carpenter and pattern shop contains twenty-five benches with complete sets of carpenter tools, twenty-three turning lathes, eight-foot pattern-maker's lathe with compound rest, pony planer, buzz planer, circular saw, scroll saw, 36-inch band saw, trimmer and power grindstone.

The forge shop has twenty stationary forges, with anvils and tools, heating furnace, four blacksmith's vises, foot-power hammer, blacksmith's drill and punch, shear and bar cutter. The blast and exhaust fans are driven by an electric motor.

The foundry has a 24-inch Colliau cupola; two brass furnaces, core oven, space for floor molding 30 feet by 40 feet, and the necessary molding tools, flasks, crucibles, ladles, tongs, etc.

The machine shop is driven by an electric motor from above, and is equipped with twenty-eight benches for vise work with complete sets of tools, eight speed lathes, sixteen engine lathes, Fox monitor turret lathe, two planers, two shapers, two milling machines, two upright drills, sensitive drill, grinding machines, tool grinders, emery wheels, etc. The tool-room contains full sets of drills, taps, dies, milling cutters, standard plugs, gauges, threads, micrometers, and a great variety of special tools.

INDUSTRIAL ARTS

1. TOOLS AND MACHINES. Three credit hours. Principles underlying the construction and operation of machine tools, and materials used in construction. Courses in Industrial Arts and Manual Training, third year; Short Course in Industrial Arts, second year, first, second and third terms, *Tu., Th., S., 8.* Prerequisite, Mathematics 14 or 32, Concurrent, Physics 1.

2. DESIGNING. Three credit hours. Problems in design, to accompany 1. Courses in Industrial Arts and Manual Training, third year; Short Course in Industrial Arts, second year, second and third terms, *F., 1-4, S., 9-12.*

3. SHOP EQUIPMENT, APPLIANCES AND MANAGEMENT. Three credit hours. Strength and durability of the materials used in construction; shop and factory buildings and their construction; power, power transmission and prime movers; methods of compensation and shop accounts and management. Course in Industrial Arts, fourth year, first, second, and third terms, *M., W., F., 11.* Prerequisite, Industrial Arts 1. Concurrent, Industrial Arts 4.

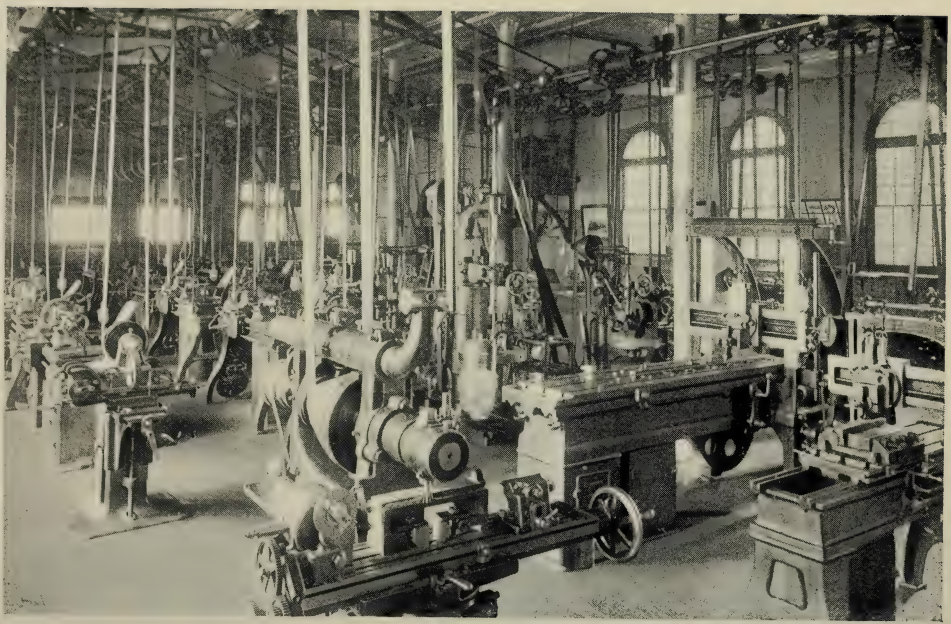
4. ADVANCED DESIGNING. Three credit hours. Graphical problems in construction. Design of buildings and the arrangement of machinery, line-shafting, etc., for manufacturing plants. Course in Industrial Arts, fourth year, first and second terms, *M., Tu., 1-4;* third term, W., *Th., 1-4.* Prerequisite, Drawing 5. Concurrent, Industrial Arts 3.

5. WORKSHOP APPLIANCES. Three credit hours. Lectures and problems on the construction of shop buildings and the arrangement of machinery; special shop appliances. Course in Mechanical Engineering, fourth year, third term, *M., W., F., 8.* Prerequisite, Civil Engineering 19.

8. MACHINE DRAWING. Three credit hours. Working sketches of mechanisms and machines from measurement; detail and assembly drawings of same. Short Course in Industrial Arts, second year, first term, *Th., F., 1-4.* Prerequisite, Drawing 39.

9. MACHINE DESIGN. Two credit hours. Practical application of the principles of machine design. Course in Electrical Engineer-

THE
JOHN CRERAR
LIBRARY



MACHINE SHOP—HAYES HALL.

ing, fourth year, second term, *M., W., 1-3.* Prerequisite, Mathematics 72 and Drawing 5.

SHOPWORK

NOTE.—For time requirements, credit given, and all similar information concerning shopwork courses, see table page 81.

3. FOUNDRY WORK. Exercises and practice in tempering sand and preparing moulds of machine parts in the sand, core-making, melting iron and brass and pouring castings. MR. RENCK.

4. CHIPPING AND FILING. Exercises and practice in vise work, including chipping in cast and wrought iron, surface filing, squaring, fitting, finishing, and the scraping of surface plates. ASSISTANT PROFESSOR KNIGHT.

7. CARPENTRY AND PATTERN MAKING. Exercises and practice in carpentry, wood-turning and pattern-making, including sawing, planing, mortising, framing and other work involving the use of the ordinary carpenter tools; center and chuck turning, the making of finished patterns; and enough elementary moulding to illustrate draft, parting, cores, etc. MR. RENCK.

8. CABINET WORK. Exercise and practice in cabinet making, including paneling, mitre and dovetail joints, etc.; use of power tools. Prerequisite, Shop 7. MR. RENCK.

9. ADVANCED PATTERN MAKING. Continuation of pattern work of Shopwork 7. MR. RENCK.

11. FORGING. The use and care of forge, fire, and tools; practice in iron and steel forging, including such operations as cutting, bending, drawing, upsetting, shaping and welding iron; the making, hardening and tempering of steel punches, chisel and lathe tools. MR. CROWE.

12. ADVANCED FORGING. Various forms of welds in iron and steel; the use of scrolling irons and of forms for duplicating work; annealing; tool making; case-hardening; tempering drills, dies and cutters; spring making; ornamental iron work; visits to shops. Prerequisite, Shop 11. MR. CROWE.

13. MACHINE WORK. Exercises and practice in hand-turning in iron and brass on speed lathes; in straight and taper turning, boring, fitting, chucking, and thread-cutting on engine lathes. ASSISTANT PROFESSOR KNIGHT.

14. MACHINE WORK. Exercises and practice on the lathe, planer, shaper, drill press and milling machine, with use of small tools as drills, taps, dies, reamers, counterborers, etc.; construction of parts of actual machines. Prerequisite, Shop 13. ASSISTANT PROFESSOR KNIGHT.

15. ADVANCED MACHINE WORK. Exercises and practice on turret lathe, universal, surface and tool grinding machines; in gear-cutting, etc. Prerequisite, Shop 14. ASSISTANT PROFESSOR KNIGHT.

16. ADVANCED MACHINE WORK. The construction and use of jigs and templates; the accurate laying out of work; the duplication of parts, the production of work rapidly and economically, etc. Prerequisite, Shop 15. ASSISTANT PROFESSOR KNIGHT.

17. ADVANCED MACHINE WORK. The making and use of special tools and fixtures, standard plugs and collars, standard caliper and limit gauges; error limits in modern machine construction; methods of testing the accuracy of machine tools, etc. Prerequisites, Industrial Arts 3 and Shop 16. ASSISTANT PROFESSOR KNIGHT.

SUMMER TERM. The Summer Term in Shopwork will begin on Monday morning preceding Commencement Day and continue for four weeks. The courses open to students are Shopwork (4) (7) (11) (13) (14) and (15), three credit hours in each.

Each course requires three hours a day for six days a week. Students electing the Ceramics or the Electrical or Mechanical Engineering Course are required to take two of the three courses, Shopwork (4) (7) and (11) at the close of their first year.

Students electing the Chemical Engineering Course are required to take Shopwork courses (7) and (11) at the close of their first or second year.

Students in the Short Course in Clay-working are required to take Shopwork (7) and (11) at the close of their first year.

The courses are open as elective to students who desire to lighten their work of the regular terms, to make up back work or to take extra work.

SHOPWORK REQUIRED

Number	Credit hours	Subject	Year	Term	Hours	Courses in
3	2	Founding	2	1	M. 3, Tu. 1-4; W. 3, Th. 1-4; or S. 8-12.......	Mech. Eng.
3	2	Founding	2	1	M. 3, Tu. 1-4..........	Short Ind. Arts.
3	3	Founding	2	1	M. 1-4; Tu. 1-4........	Ind. Arts; Man. Tr.
3	2	Founding	..	2	M. 3, Tu. 1-4..........	....
4	3	Chipping and Filing	2	1	W. 1-4; Sat. 9-12......	Short Ind. Arts.
4	3	Chipping and Filing	..	......	(See Courses)	El. Eng.; Mech. Eng.
4	3	Chipping and Filing	3	1	M. Tu. 1-4............	Ind. Arts.
4	3	Chipping and Filing	3	1	M. Tu. 9-12...........	Manual Train.
7	2	Woodworking	2	1	M. F. 10-12...........	Mining Eng.
7	3	Woodworking	1	1	M. Tu 1-4............	Short Ind. Arts
7	3	Woodworking	2	1	Th. Fr. 1-4...........	Manual Train.
7	3	Woodworking	2	1	Th. Fr. 1-4	Ind. Arts.
7	3	Woodworking	..	......	(See Courses)	Chem., El. & Mec. E.
8	3	Cabinet Work	2	3	M. Tu. 1-4............	Ind. Arts; Man. Tr.
9	3	Adv. Pattern Work	2	1	Tu. Th. 9-12; or Th.. Fri, 1-4............	Mech. Eng.
9	3	Adv. Pattern Work	1	2	M. Tu. 1-4............	Short Ind. Arts,
9	3	Adv, Pattern Work	2	2	M. Tu. 1-4	Ind. Arts; Man. Tr.
9	3	Adv, Pattern Work	..	......	(See Course)	Mech. Eng.
11	3	Forging	..	......	(See Courses)	Chem. El, & Mec. E.
11	2	Forging	2	2	Th. F. 10-12	Mining Eng.
11	3	Forging	2	2	Th. F. 1-4	Ind. Arts; Man. Tr.
11	3	Forging	1	3	M. Tu. 1-4............	Short Ind. Arts.
11	3	Forging	1	3	M. Tu. 1-4............	Short Mining.
12	3	Adv. Forging	2	3	Th. Fri. 1-4	Ind. Arts; Man. Tr,
13	3	Machine Work......	2	2	M. Tu. 1-4; or W. Th. 1-4; or F. 1-4. S. 8-11	Elec. Eng,
13	3	Machine Work......	3	2	M, Tu. 9-12...........	Man. Train.
13	3	Machine Work......	3	2	M. Tu. 1-4............	Ind. Arts.
13	3	Machine Work......	2	2	W. Th. 1-4............	Short Ind. Arts.
13	3	Machine Work......	2	3	M. Tu. 1-4; or F. 1-4 S. 8-11	Mech. Eng.
14	3	Adv. Machine Work	3	1	M, Tu, W. 8-10 or Th. F. S. 8-10.	Elec. Eng.
14	3	Adv. Machine Work	3	1	M. Tu. Th. 10-12; or M. Tu. 1-4..........	Mech. Eng.
14	3	Adv, Machine Work	2	3	W. Th. 1-4............	Short Ind, Arts.
14	3	Adv. Machine Work	3	3	M. F. 9-12............	Manual Training.
14	3	Adv. Machine Work	3	3	M. Tu. 1-4............	Ind. Arts.
15	3	Adv. Machine Work	4	1	F. 1-4; S. 8-11.........	Ind. Arts; Man. Tr.
15	4	Adv. Machine Work	3	2	M. Tu. Th. F. 10-12; or F. 1-5, S. 8-12 ...	Mech. Eng.
16	3	Adv. Machine Work	4	2	M. W. F. 8-10.........	Ind. Arts; Man. Tr.
17	3	Adv. Machine Work	4	3	M. Tu. 1-4............	Ind. Arts.

MATHEMATICS

Office, University Hall, Room 314.

PROFESSOR BOHANNAN, ASSOCIATE PROFESSOR MCCOARD, ASSOCIATE PROFESSOR BOYD, ASSISTANT PROFESSOR ARNOLD, ASSISTANT PROFESSOR SWARTZEL, ASSISTANT PROFESSOR KUHN, ASSISTANT PROFESSOR CODDINGTON, MR. RASOR, MR. COX, MR. KINDLE.

2. ELEMENTARY ALGEBRA. Five credit hours. Short Courses in Clay Working, Industrial Arts, and Mining, first year, first, second and third terms, *M., Tu., W., Th., F., 9.* Text book: Venable's Easy Algebra.

3. PLANE GEOMETRY. Five credit hours. Short Courses in Clay Working, Industrial Arts, and Mining, first year, first term, ***M.,*** *Tu., W., Th., F., 11.* Text book: Venable's Geometry.

11. DIFFERENTIAL EQUATIONS. One credit hour. Course in Mechanical Engineering, third year, first term, *F., 10.* Prerequisite, Mathematics 43. Text book: Boyd's Differential Equations.

13. SOLID GEOMETRY. Five credit hours. Short Courses in Clay Working, Industrial Arts, and Mining, first year, second term, *M., Tu., W., Th., F., 11.* Prerequisite, Mathematics 3. Text book: Venable's Geometry.

14. TRIGONOMETRY. Plane trigonometry. Five credit hours. Short Courses in Clay Working, Industrial Arts, and Mining, first year, third term, *M., Tu., W., Th., F., 8.* Text book: Bohannan's Trigonometry.

31. COLLEGE ALGEBRA. Five credit hours. All four-year courses, first year, first term, *M., Tu., W., Th., F., 8, 9, 11, 1 or 2.* Text Book: Fine's College Algebra.

This course is repeated in the second term for the benefit of students who fail in it in the first term.

32. TRIGONOMETRY. Five credit hours. All four-year courses, first year, second term, *M., Tu., W., Th., F., 8, 9, 11, 1 or 2.* Text book: Bohannan's Trigonometry.

This course is repeated in the third term for the benefit of students who fail in it the second term.

33. ANALYTICAL GEOMETRY. Five credit hours. All four-year courses, first year, third term, *M., Tu., W., Th., F., 8, 9, 11, 1 or 2.*

Prerequisite, Mathematics 32. Text book: Ashton's Analytical Geometry.

This course is repeated in the Summer Term.

41. CALCULUS. Five credit hours. Second year, first term.
M., Tu., W., Th., F., 1—Course in Architecture.
" *8*—Course in Ceramics.
" *8*—Course in Chemical Engineering.
" *11 or 1*—Course in Civil Engineering.
" *8*—Course in Electrical Engineering.
" *8*—Course in Mechanical Engineering.
" *8*—Course in Mine Engineering.
Prerequisite, Mathematics 33. Text book: Osborne's Calculus.

42. CALCULUS. Five credit hours. Second year, second term. For hours and courses see Course 41. Prerequisite, Mathematics 41. Text book: Granville's Calculus.

43. CALCULUS. Five credit hours. Second year, third term. For hours and courses see Course 41. Prerequisite, Mathematics 41. Text book: Granville's Calculus.

71. MECHANICS. Statics. Five credit hours. Courses in Architecture, Ceramics and Chemical, Civil, Electrical, Mechanical and Mine Engineering, third year, first term, *M., Tu., W., Th., F., 8, 9, or 11.* Prerequisite, Mathematics 43. Text book: Hoskin's Theoretical Mechanics.

72. MECHANICS. Strength of Materials. Kinetics. Five credit hours. Courses in Architecture, Ceramics, and Chemical, Civil, Electrical, Mechanical, and Mine Engineering, third year, second term, *M., Tu., W., Th., F., 8, 9, 11 or 2.* Prerequisite, Mathematics 71. Text book: Heller's Stresses in Structures, Goodman's Mechanics Applied to Engineering.

73. MECHANICS. Kinetics and Hydraulics. Five credit hours. Courses in Ceramics and Chemical, Civil, Electrical, Mechanical, and Mine Engineering, third year, third term, *M., Tu., W., Th., F., 8, 9 or 11.* Prerequisite, Mathematics 72. Text books: Hoskin, Goodman.

74. DIFFERENTIAL EQUATIONS. Three credit hours, second term. Elective. Prerequisite, Mathematics 43. Text book: Boyd's Differential Equations.

MECHANICAL ENGINEERING

Office, Hayes Hall, Room 11.

PROFESSOR MAGRUDER, PROFESSOR HITCHCOCK, ASSISTANT PROFESSOR JUDD, ASSISTANT PROFESSOR KING, MR. HOPKINS, MR. RIGDON.

The lectures and recitations of this department are held in Hayes Hall, and the laboratory work in Mechanical Hall. The technical museum in Hayes Hall contains samples of engineering supplies and materials and a collection of models of mechanism and valve gears.

The laboratories are arranged to carry on experiments and investigations along the following general lines: Strength of materials in compression, tension, torsion, cross-breaking and shearing; gas, hot air, and steam engines, under varied conditions of running; hydraulics, including pumps and water-wheels; pneumatics, including air-brakes, compressors, fans and ventilating systems; power transmission, including belts, pulleys and oils; boiler testing; calibration of instruments.

Some of the principal machines for the above work are Olsen and Riehlé testing machines; four gas and oil engines; Ericsson and Rider hot-air engines; three 35-horse power horizontal and one vertical, simple and compound, steam engines with condensers; simple, compound, triplex, centrifugal and rotary pumps, pulsometer, turbine and impulse wheels, tanks, weirs, meters, hydraulic engines and rams; set of Westinghouse air-brake apparatus, air-compressors, compressed air engine, blower and ventilating fans; belt machines, lubricant and oil testers; Robinson experiment steam boiler, with natural, forced, and induced drafts, air-preheater, and economizer; calorimeters, injectors, gauges. The University power and refrigerating plants and the mechanical equipments in the different buildings upon the grounds add to the facilities for engineering tests.

Besides the above, opportunities frequently arise for the students to take part in tests made of machinery, engines and boilers in the city and vicinity.

3. MECHANISM. Five credit hours. Lectures and recitations on the principles of mechanism and mechanical movements. Course in Mechanical Engineering, third year, second term, *M., Tu., W., Th., F., 8.* Prerequisite, Drawing 33 and Physics 2. The accurate laying out of movements, embodying the principles of mechanism. Two credit hours. Course in Mechanical Engineering, third year, third term. *Time to be arranged.* PROFESSOR HITCHCOCK.

12. EXPERIMENTAL ENGINEERING LABORATORY. Two credit hours. Calibration of pressure gauges and indicator springs; steam engine indicator practice and oil testing. Course in Mechanical Engineering, third year, first term, *W., 1-5, S., 8-12.* Course in Industrial Arts, fourth year, first term, *Th., 1-5.* Prerequisite, Drawing 33. Concurrent, Mathematics 71, or Industrial Arts 3. ASSISTANT PROFESSOR KING AND MR. RIGDON.

14. CONTINUATION OF 27, including testing of steam boilers and injectors. Four credit hours. Course in Mechanical Engineering, fourth year, second term, *M., W., 1-5.* Concurrent, Mechanical Engineering 34. PROFESSOR HITCHCOCK, ASSISTANT PROFESSORS JUDD AND KING.

15. CONTINUATION OF 14, including testing of steam, centrifugal, and power pumps, pulsometer, hydraulic rams, impulse and turbine water-wheels and air compressors. Three credit hours. Course in Mechanical Engineering, fourth year, third term, *M., Tu., 9-12.* PROFESSOR HITCHCOCK, ASSISTANT PROFESSORS JUDD AND KING.

17. EXPERIMENTAL ENGINEERING. Three credit hours. Practice in the testing of materials of construction, calibration of orifices and weirs, study of the flow of liquids and gases, accompanied by lectures and recitations on laboratory practice, steam engines, boilers and power transmission. Course in Civil Engineering, fourth year, second term, *Th., 11, F., 1-5.* Prerequisite, Drawing 33 and Mathematics 73. PROFESSOR HITCHCOCK, ASSISTANT PROFESSORS JUDD AND KING.

18. MACHINE DESIGN. Five credit hours. Recitations on Unwin's Machine Design, with lectures on American practice. Courses in Chemical and Mechanical Engineering, fourth year, first and second terms, *M., Tu., W., Th., F., 9.* Prerequisite, Drawing 5 or 33; Mathematics 73. PROFESSOR MAGRUDER.

19. MACHINE DESIGN. Five credit hours. Practical applications of the principles of machine designs. Courses in Chemical and Mechanical Engineering, fourth year, third term, *M., 1-5, Tu., W., 1-4.* Prerequisite, Mechanical Engineering 18. PROFESSOR MAGRUDER.

21. THESIS WORK. Five credit hours. Course in Mechanical Engineering, fourth year, third term. PROFESSORS MAGRUDER AND HITCHCOCK.

23. MATERIALS OF CONSTRUCTION. Five credit hours. Lectures and recitations on the materials used in architectural and building construction, and laboratory exercises on their properties. Course in Architecture, fourth year, first term, *Tu., Th., 8, W., 1-5.* Prerequisite, Mathematics 71. PROFESSOR HITCHCOCK.

24. EXPERIMENTAL ENGINEERING LABORATORY. Three credit hours. Arranged to meet the needs of those desiring to elect advanced laboratory work. First and second terms. Elective to third and fourth year engineers. (Not given in 1906-7.)

25. CONTINUATION OF 17, including tests of steam, power, rotary and centrifugal pumps; water motor and turbine wheel. Five credit hours. Course in Civil Engineering, fourth year, third term, *Th., 11, M., Tu., 1-5.* PROFESSOR HITCHCOCK, ASSISTANT PROFESSORS JUDD AND KING.

27. CONTINUATION OF 12, including testing materials of construction, tests of steam and hot air engines, transmission and absorption dynamometer trials and testing of belts. Five credit hours. Course in Mechanical Engineering, fourth year, first term, *M., 1-5, F., 10-5.* Concurrent, Mechanical Engineering 33. PROFESSOR HITCHCOCK, ASSISTANT PROFESSORS JUDD AND KING.

28. EXPERIMENTAL ENGINEERING LABORATORY. Two credit hours. Testing of pressure gauges and indicator springs, steam engine indicator practice and testing of lubricating oils. Course in Electrical Engineering, third year, third term, *Th. or F., 1-5.* Course in Manual Training, fourth year, third term, *F., 1-5.* Concurrent, Mechanical Engineering 32. ASSISTANT PROFESSORS JUDD AND KING, AND MR. RIGDON.

29. CONTINUATION OF 28, including testing materials of construction, transmission and absorption dynamometer tests, steam engine trials. Three credit hours. Course in Electrical Engineering, fourth year, first term, *Tu., or Th., 10-12, 1-5.* Two credit hours. Course

EXPERIMENTAL ENGINEERING LABORATORY.

THE
JOHN CRERAR
LIBRARY

in Industrial Arts, fourth year, second term, *W., 1-5.* ASSISTANT PROFESSORS JUDD AND KING AND MR. RIGDON.

30. CONTINUATION OF 29, including steam engine and boiler trials, steam and power pump tests and hydraulic experimentation, gas and oil engine trials. Two credit hours. Course in Electrical Engineering, fourth year, second term, *Tu., or Th., 1-5.* Course in Industrial Arts, fourth year, third term, *F., 1-5.* ASSISTANT PROFESSORS JUDD AND KING AND MR. RIGDON.

31. HYDRAULIC MACHINERY. Three credit hours. Recitations and lectures on pumping machinery. Course in Mechanical Engineering, fourth year, third term, *Tu., Th., 8, W., 9.* Prerequisite, Mathematics 73 and Mechanical Engineering 33. PROFESSOR HITCHCOCK.

32. MECHANICAL ENGINEERING OF POWER PLANTS. Five credit hours. A descriptive study of steam and gas engines, boilers, pumps, injectors and other machinery used in plants generating power. Courses in Chemical and Electrical Engineering and Industrial Arts, third year, third term, *M., Tu., W., Th., F., 9.* Course in Mechanical Engineering, third year, third term, *M., Tu., W., Th., F., 8.* Course in Manual Training, fourth year, third term, *M., Tu., W., Th., F., 8.* Prerequisite, Mechanical Engineering 3, or Industrial Arts 1; Drawing 5 or 22; and Physics 2. PROFESSOR MAGRUDER.

33. STEAM ENGINES AND BOILERS. Five credit hours. A detail study of steam using and steam generating machinery. Courses in Electric and Mechanical Engineering, fourth year, first term, *M., Tu., W., Th., F., 8.* Prerequisite, Mathematics 73 and Mechanical Engineering 32. PROFESSOR MAGRUDER.

34. THERMODYNAMICS. Five credit hours. The transmutations of heat and mechanical energies in steam, gas and air engines, in air and ammonia compressors and in refrigeration machines, together with a study of the tests of ideal and actual engines and of their indicator diagrams; the flow of gases through pipes and orifices. Course in Mechanical Engineering, fourth year, second term, *M., Tu., W., Th., F., 8.* Prerequisite, Mechanical Engineering 33. PROFESSOR MAGRUDER.

35. EXPERIMENTAL ENGINEERING LABORATORY. Five credit hours. Testing of pressure gauges and indicator springs followed by steam engine indicator practice with engine and pump economy tests; testing of lubricating oils; ventilating fan trials and boiler fuel tests; accompanied by lectures relating to apparatus used in the experimen-

tations. Option, Course in Chemical Engineering, fourth year, second term, *F., 11, Th., F., 1-5.* Prerequisite, Mathematics 73 and Mechanical Engineering 32.

36. EXPERIMENTAL ENGINEERING LABORATORY. Five credit hours. Lectures and recitations on power transmission, steam engines and boilers. Laboratory; testing pressure gauges, indicator springs, etc.; valve setting; testing of steam engines, steam, power and centrifugal pumps; boiler and fuel trials. Courses in Ceramics and Mine Engineering, fourth year, third term, *Tu., Th., 10-11, W., Th., 1-4.* Prerequisite, Mathematics 73 and Metallurgy 4. PROFESSOR HITCHCOCK, ASSISTANT PROFESSORS JUDD AND KING.

37. MECHANISM. Four credit hours. Lectures and recitations on the principles of mechanism and mechanical movements. Courses in Ceramics and Electrical Engineering, third year, second term, *M., Tu., Th., F., 10.* PROFESSOR HITCHCOCK.

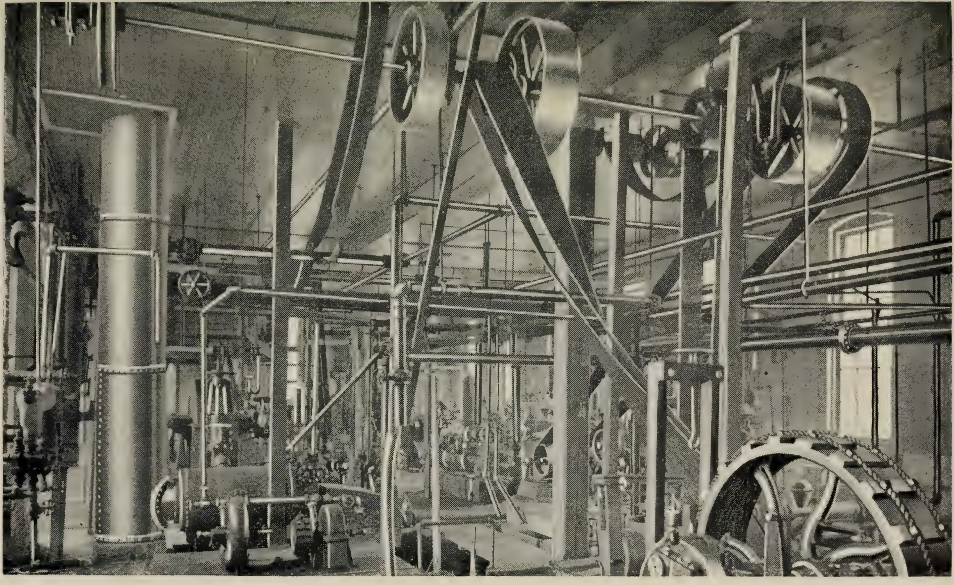
38. INSPECTION TRIP TO THE EAST. Includes Pittsburg, Buffalo, Niagara Falls, Cleveland, and possibly other places; is taken at the end of the Winter term and occupies six days. The entire expense need not exceed $30.00. A satisfactory written report upon the work of the trip is required. Given only in the even years. Required in the Course in Mechanical Engineering, third or fourth year.

39. INSPECTION TRIP TO THE WEST. Includes Chicago, Milwaukee, Cincinnati, and possibly other places; is taken at the end of the Winter term and occupies six days. The entire expense need not exceed $30.00. A satisfactory written report upon the work of the trip is required. Given only in the odd years. Required in the Course in Mechanical Engineering, fourth or third year.

40. WRITTEN REPORT. Course of assigned reading upon processes of manufacture and power plants may be reported upon by third and fourth year students in the Course in Mechanical Engineering as a substitute for 38 on presentation of reasons satisfactory to the head of the department.

41. SIMILAR TO 40. A substitute for 39.

42. HEATING AND VENTILATING. Three credit hours. Recitations and lectures on the principles and methods of heating and ventilation, with laboratory work and investigations of the heating and ventilating plants of different buildings. Course in Architecture, fourth year, second term, *M., W., F., 11.* PROFESSOR HITCHCOCK.



MECHANICAL LABORATORY.

THE
JOHN CRERAR
LIBRARY

METALLURGY AND MINERALOGY

Office, School of Mines Building.

PROFESSOR N. W. LORD, ASSISTANT PROFESSOR SOMMERMEIER.

The equipment of the Department of Metallurgy is unusually complete. It occupies about 14,000 square feet of floor space in the new School of Mines building, which has just been built and equipped at a cost of $110,000. It includes a chemical laboratory with accommodations for forty students, an assay laboratory in a fire-proof wing, laboratories for general and determinative mineralogy, technical gas analysis, coal sampling and testing, including determinations of heating value, microscopic metallographic work, crushing and sampling plant for use in experimental tests on ores and minerals, together with lecture rooms, museum, and offices.

2. MINERALOGY. Three credit hours. Lectures arranged so as to be preparatory to Determinative Mineralogy (Course 3). Courses in Chemical and Mining Engineering, second year, third term, *M., W., F., 11.* Prerequisite, Chemistry 12.

3. DETERMINATIVE MINERALOGY. Five credit hours. Laboratory course in practical determination of minerals by physical and chemical tests. Each student is furnished with a set of apparatus, and works under an instructor's inspection. Brush's Determinative Mineralogy is used as a manual. Course in Mine Engineering, third year, third term, *M., Tu., 1-5.* Prerequisite, Metallurgy 2.

4. METALLURGY. Five credit hours. A course of lectures upon fuel and its uses, iron and steel, copper, lead, gold and silver, their properties, tests, ores and details of the methods of reduction. The lectures are supplemented by a careful study of references to standard works and journals. Course in Mine Engineering, third year; Option, Course in Chemical Engineering, fourth year, first and second terms, *M., Tu., W., Th., F., 9.* Courses in Industrial Arts and Mechanical Engineering, third year; Course in Ceramics, fourth year, first term, *M., Tu., W., Th., F., 9.* Two credit hours. Courses in Industrial Arts and Mechanical Engineering, third year, first two-fifths of the second term, *M., Tu., W., Th., F., 9.* Prerequisite, Chemistry 12 and Physics 2.

5 METALLURGICAL LABORATORY. Five credit hours. Lectures and laboratory work. Laboratory practice in the analysis of iron and steel, fuel and slags, and the assay of lead, copper and zinc ores by wet methods, using approved methods as practiced in technical laboratories and metallurgical works. Course in Mine Engineering, second year, first, second and third terms; Course in Chemical Engineering, third year, first term, *W., Th., F., 1-4.* Prerequisite, Chemistry 12.

6. ASSAYING. Five credit hours. Laboratory work. Practical work in the assaying of gold, silver and lead ores, by furnace methods. Courses in Chemical and Mine Engineering, third year, second term, *M., Tu., 11, 1-5.* Prerequisite, Metallurgy 5, one term.

7. METALLURGICAL CONSTRUCTION. Three credit hours. Practice in the designing of furnaces and other metallurgical machinery, including detail drawings and estimates. Course in Mine Engineering, fourth year, second term, *Th., F., 1-4.* Prerequisite, Drawing 5, Mathematics 73, Metallurgy 6 and 8.

8. ORE DRESSING AND COAL WASHING. Two credit hours. Methods of concentrating and enriching ores and fuels by mechanical means. Lectures, with reference to standard books and various papers in technical journals. Course in Mine Engineering, fourth year, first term, *Tu., F., 10.* Prerequisite, Metallurgy 4.

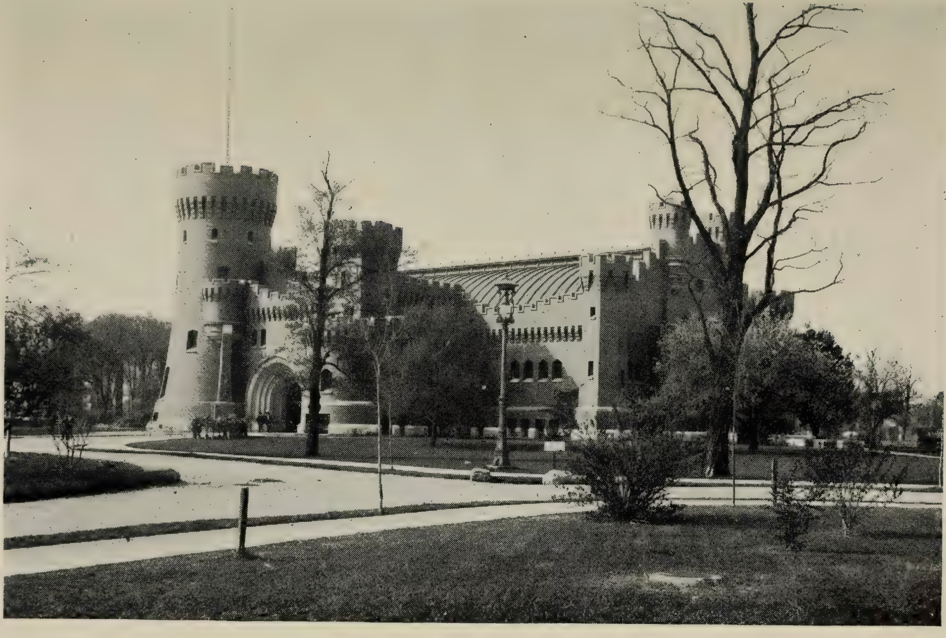
9. MINERAL CHEMISTRY. Five credit hours. Lectures upon fire-damp, mine explosions, explosives, boiler waters, poisonous gases, iron ores; iron and steel, their properties and modes of manufacture; coal and coke. Short Course in Mining, second year, third term, *M., Tu., W., Th., F., 8.* Prerequisite, Chemistry 3.

MILITARY DRILL

Office, Armory Room.

CAPTAIN GEORGE L. CONVERSE, U. S. A., RETIRED.

The same building used as a gymnasium is also employed as Armory and Drill Hall. The University Battalion is in charge of a commandant from the United States Army, apart from whom it is officered entirely by students. Besides its military importance, as shown by the prominent place taken by former students in the Ohio troops of the



THE ARMORY AND GYMNASIUM.

THE
[illegible]
[illegible]

late war and in the United States Army, military drill has great value in the physical development of the student.

The fall work is carried on outdoors, weather permitting, and is largely devoted to squad drill in the setting-up exercises, facings, marching, etc., and company drill according to progress of the squads. During the winter months drill is confined to work inside the gymnasium, manual of arms, guard mounting and such ceremonies as can be performed within a limited space. After April 1st all work is again outside, weather permitting, as follows: Mondays, company drill; Tuesdays, battalion drill; Wednesdays, ceremonies other than guard mounting; Thursdays, guard mounting and company drill. During the entire year, at the same hours as the drill, the O. S. U. Band either has its practice hour or takes part in ceremonies and drill. Similarly the Signal Corps belonging to the battalion exercises in the flag drill or at telegraph work. Army regulations are followed strictly. The military department is open five days per week of each term.

1. MILITARY DRILL. Four times a week, from the opening of College until the Thanksgiving vacation; twice a week from Thanksgiving until April first; four times a week until the close of the school year. Required of all able-bodied male students during first and second years of their course.

2. TACTICS. Lectures and recitations. Twice a week. Second term. Elective.

4. CUSTOMS OF THE SERVICE. Lectures and recitations. Twice a week. Second term. Required of the whole battalion.

MINE ENGINEERING

Office, School of Mines Building.

PROFESSOR RAY, MR. SIMON.

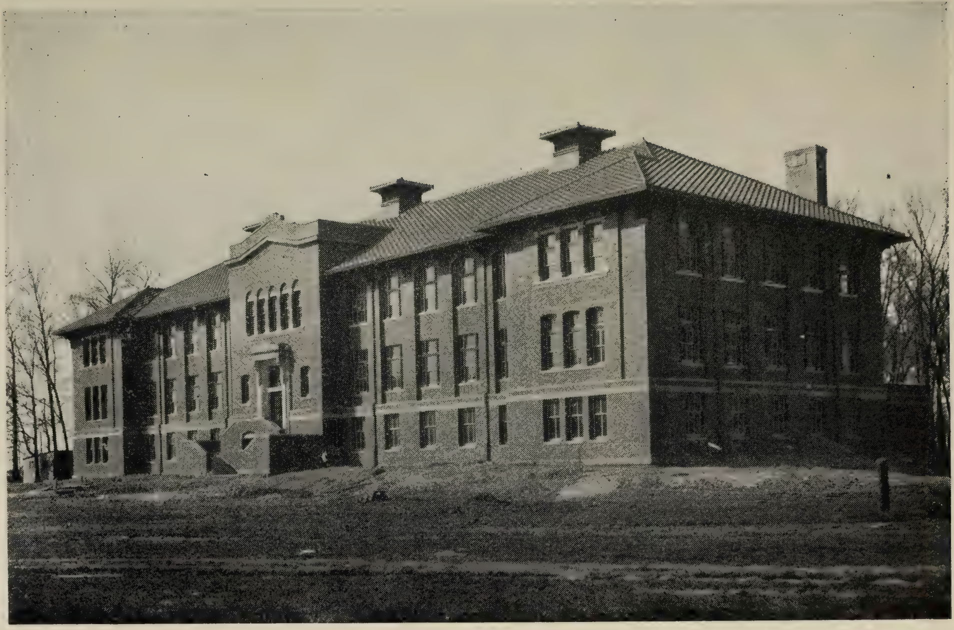
This department is equipped with all of the latest improved instruments and apparatus used in mine engineering, surveying, and the study of mine ventilation. There is a collection of models of mine machinery and supplies, to which additions are being made; also a large collection of lantern views of machines, mines, and mine equipment. In the draughting room each student is personally taught the making of maps, the platting of actual surface and underground surveys, the making of drawings, tracings, and blueprints. Emphasis is laid upon proper methods of keeping notes and all records necessary to an efficient engineer's office. The students make actual surveys of coal mines, and work up their notes complete in all of the necessary details. They are also taught how to make working drawings, plans, estimates, and specifications of mining operations and equipment.

The Mine Engineering Course pays special attention to underground surveying, mapping, timbering, ventilation, and other matters relating to safety and speed, system and method in extracting coal and other minerals. The coal mines of Central Ohio furnish extremely valuable illustrations of the practice in these lines, and of the general arrangement of mining plants. The mining students are required to make frequent trips and to spend sufficient time at the mines in actual work and observation to become familiar with practical mine surveying and the details of mine equipment and management.

1. MINE SURVEYING. Five credit hours. Lectures and field practice. This is similar to Course 4, but more elementary. The same text is used. The students have more practice in the drawing room. Short Course in Mining, second year, first term, *M., Tu., W., Th., F., 11.* Prerequisite, Mathematics 14.

2. VENTILATION AND HAULAGE. Five credit hours. Lectures illustrated by experiments and maps of mines and models when possible, tests by safety lamps and anemometers, and methods of air distribution in coal mines. Short Course in Mining, second year, second term, *M., Tu., W., Th., F., 11.* Prerequisite, Mine Engineering 1 and Physics 1.

3. MINE OPERATING. Five credit hours. A course of lectures and practical instruction in mine book-keeping and accounts, cost of working, etc., particularly adapted to Ohio coal mining. Short



SCHOOL OF MINES BUILDING.

THE
JOHN CRERAR
LIBRARY

Course in Mining, second year, third term, *Tu., Th., F., 10, M., 9-11.* Prerequisite, Mine Engineering 2.

4. Mine Surveying. Five credit hours. Field practice in the use of instruments for surface and underground surveys. Full notes are taken and maps and plans made in the drawing-room. Davies's Surveying by Van Amringe is used as a text-book. Courses in Mine Engineering and Ceramics, third year, first term, *M., Tu., Th., F., 10; M., 1-3.* Prerequisite, Drawing 33 and Mathematics 32.

5. Mine Engineering. Five credit hours. Lectures. Mine operating, mining machinery, ventilation, shaft-sinking, working out deposits, etc. Constant reference is required to the standard works and to the leading technical journals, with practice in designing mine plants, draughting, and estimates. Course in Mine Engineering, fourth year, first, second and third terms, *M., Tu., W., Th., F., 8.* Prerequisite, Mathematics 73 and Mine Engineering 4. Concurrent, Geology 2.

6. Plans and Specifications. Five credit hours. Course in Mine Engineering, fourth year, third term, *M., F., 10; M., Tu., 1-4.* Prerequisite, Metallurgy 7 and Mine Engineering 5.

7. Surveying. One credit hour. Practical experience in surveying in some mine convenient to Columbus; the time taken in one trip of not more than four consecutive days. Course in Mine Engineering, third year; Short Course in Mining, second year; second term. Prerequisite, Mine Engineering 1 or 4.

PHYSICS

Office, Physics Building, First Floor.

Professor Thomas, Professor Cole, Assistant Professor Kester, Assistant Professor Earhart, Mr. Clawson, Mr. Heil.

The department of Physics occupies the three stories and basement of the new Physics Building, a building in the design and construction of which special care has been taken to secure ample light, ventilation, and rigidity of floors and supports. The floor area of the building is thirty thousand square feet. The two wings included in the plan of the building will, when erected, add twenty-five thousand square feet of floor area. The department has a generous supply of apparatus for the experimental illustration of the lecture courses, and for elementary and advanced laboratory work. The best instrument makers of this and foreign countries are well represented in the equipment, which is especially strong in standards, and in apparatus for precise measurement.

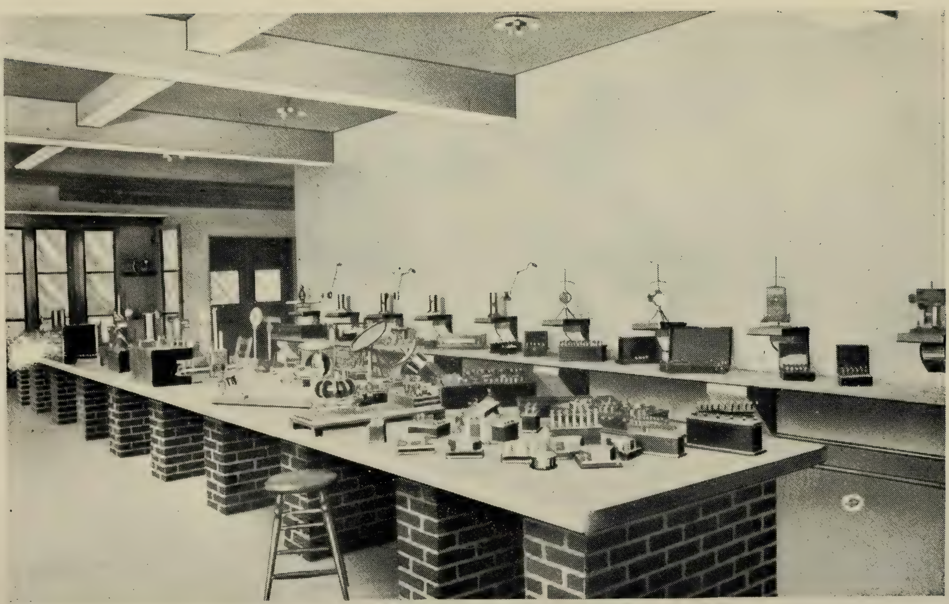
1. ELEMENTARY PHYSICS. Recitations, experimental lectures and laboratory. Text: Carhart & Chutes' "Elements of Physics." Five credit hours. Short Course in Mining, first year, first and second terms, *M., Tu., Th., F., 8,* and one three-hour laboratory period, any afternoon, 1 to 4, or Saturday morning. Short Courses in Clayworking and Industrial Arts, second year, first and second terms, *M., Tu., Th., F., 11,* and one laboratory period, as above. Prerequisite, Mathematics 14. DR. EARHART.

2. **GENERAL PHYSICS. Three credit hours. Lectures and recitations.** All four-year courses, second year, first, second, and third terms, *M., W., 9 or 3.* Quiz to be arranged. Prerequisite, Mathematics 33. PROFESSOR THOMAS.

3. PHYSICS. Two credit hours. Extension of Course 2, with practice in solution of problems. Courses in Electrical Engineering, Ceramics, Industrial Arts and Manual Training, second year, first, second and third terms, *Tu., Th., 9.* Concurrent, Physics 2.

4. ELECTRICITY AND MAGNETISM. Three credit hours. Lectures and recitations. Course in Electrical Engineering, third year, first term, *M., Tu., Th., 10.* Prerequisite, Mathematics 43 and Physics 2 and 3. PROFESSOR THOMAS.

5. PHYSICAL LABORATORY. Four credit hours. Elementary manipulation. Length, mass and time measurements. Work in density, elasticity and in heat. Course in Electrical Engineering, second year, third term, *M., Tu., 1-4, W., 1-3; or Th., F., 1-4, S., 8-10.* Option, Course in Manual Training, third year, first, second and third terms, *M., Tu., 1-4, W., 1-3.* Prerequisite, Physics 2.



ELECTRICAL MEASUREMENTS LABORATORY—PHYSICS BUILDING.

6. PHYSICAL LABORATORY. Five credit hours. Theory and practice of magnetic and electrical measurement, including the testing and standardizing of instruments; conductivity of conductors; insulation, capacity and resistance of insulated conductors and cables; temperature co-efficients; commercial measuring and testing instruments; strength and distribution of magnetic fields; magnetic movements, permeability; work in light, including optical constants; spectroscopy; photometry of gas, electric and other lights. Course in Electrical Engineering, third year, first and second terms, *M., Tu., W., 1-4.* Prerequisites, Physics 5. Concurrent, Physics 4.

7. PHYSICAL LABORATORY. Two credit hours. Course in Mechanical Engineering, second year, second term, *M., Tu., 1-3; or Th., F., 1-3.* Three credit hours. Course in Mechanical Engineering, second year, third term, *M., Tu., 1-4; or Th., F., 1-4.* Three to five credit hours. First, second and third terms. Elective. Concurrent, Physics 2.

9. PHYSICAL LABORATORY. Three to five credit hours. A second year's work in Physical Laboratory. Elective. Prerequisite, Physics 6 or 7.

POLITICAL SCIENCE

(See American History and Political Science.)

ROMANCE LANGUAGES AND LITERATURES

Office, Room 305, University Hall.

PROFESSOR BOWEN, ASSOCIATE PROFESSOR BRUCE, ASSISTANT PROFESSOR INGRAHAM, MISS HASKELL, MISS JACKSON, MRS. FAIRFIELD.

I. French

1. ELEMENTARY FRENCH. Four credit hours. Three terms. Grammar: Fraser and Squair's or Aldrich and Foster's Foundations. Reader: Bowen's First Scientific. Historical and narrative prose; one or more prose comedies. Required of all students who offer partial credit in French as their entrance language. Offered as alternative with German 1 and Spanish 1 to all students who enter with full or partial credit in Latin or Greek, or without previous language training. *Sec. I, M., Tu., Th., F., at 10; Sec. II, M., Tu., Th., F., at 11; Sec. III, Tu., W., Th., F., at 2; Sec. IV, Tu., W., Th., F., at 3.*

2. MODERN FRENCH LITERATURE. Four credit hours. The study of the literature as such is taken up, the work of the year covering two or more of the following subjects: (1) Contes; (2) The Novel (Balzac or Hugo); (3) Lyric Poetry (Bowen's Modern French Lyrics or Canfield's French Lyrics); (4) Romantic Drama (Hugo). Prose Composition. Lectures. Private reading required. Special emphasis of syntax and idiom. *Sec. I, M., Tu., Th., F., at 10; Sec. II, M., Tu., Th., F., at 11; Sec. III, Tu., W., Th., F., at 2.* Prerequisite, course 1 or equivalent. ASSOCIATE PROFESSOR BRUCE, MISS HASKELL, MR. ———.

3. SCIENCE READING. Four credit hours. Third term. Herdler's Scientific Reader and Luquiens' Popular Science, or other similar works. A course of rapid reading introductory to the vocabulary of scientific literature. *M., Tu., W., Th., at 9.* Prerequisite, course 2, first and second terms. ASSISTANT PROFESSOR INGRAHAM.

II. Spanish

1. ELEMENTARY SPANISH. Four credit hours. Three terms. Grammar (Hill's and Ford's or Edgren's), and Ingraham's Victoria y Otros Cuentos. Easy prose and plays. Composition and conversation. Required of all students who offer partial credit in Spanish as their entrance language. Offered as alternative with German I and French 1 to all students who enter with full or partial credit in Latin or Greek, or without previous language training *Sec. I, M., Tu., W., Th., at 9. Sec. II, M., Tu., Th., F., at 11. Sec. III and IV, Tu., W., Th., F., at 3.* ASSISTANT PROFESSOR INGRAHAM, MISS HASKELL, MR. ———.

2. MODERN SPANISH LITERATURE. Four credit hours. Three terms. The Modern Novel and Drama. Lectures covering a survey of the literature. Composition and conversation continued. *Tu., W., Th., F., at 2.* Prerequisite, Course 1 or equivalent. ASSISTANT PROFESSOR INGRAHAM.

SHOP WORK

(See Industrial Arts.)

SPANISH

(See Romance Languages.)

THE STILLMAN W. ROBINSON FELLOWSHIP IN ENGINEERING

The Stillman W. Robinson Fellowship in Engineering, endowed by Emeritus Professor Robinson for the encouragement of graduate research work in engineering, provides three hundred ($300.00) dollars annually, and is open to graduates in Mechanical, Civil, and Electrical Engineering. Any student to whom this fellowship is awarded must devote his entire time to the work, which shall amount to at least sixteen hours per week, of which at least eight shall be in the line of original research or investigation.

This fellowship will be awarded on the Friday preceding Commencement Day. All applications must be filed with the commitee on or before the first of June of the same year, and must include a general outline of the course of study and research proposed. This must show a definite object to be attained. The application may be for one or two years, preference being given to candidates electing the two-year course. No one will be registered for this graduate course of research who does not satisfy the committee of the Faculty that he has the necessary capacity, fitness, and preparation to pursue the work with advantage, and promise of ultimate success.

Great importance will be attached not only to the course laid out to be pursued by the applicant, but to his personal fitness for the work and to his ability to prepare a dissertation or thesis respecting the same which shall be in every way a creditable production, and form a contribution to knowledge. The investigation may consist of experimental research, or of mathematical analysis, but it usually will be expected to embrace both forms of study. By the beginning of the first year the student must have prepared and submitted a well-defined course, and have registered for this fellowship. Throughout the course of study the student will proceed under the care of the professor who has charge of the line of work being pursued, the same consisting of occasional consultation, instead of recitations.

Students completing the two-year graduate course under the conditions of this fellowship will receive the degree of D. M.E., D. C.E., or D. E.E., according to the course taken. Students electing and completing a one-year course will receive the corresponding Master's degree.

The applications for this fellowship, the approval of the courses of study, the acceptance of the theses, and the recommendations for degrees, are to be passed upon by a committee of the Faculty consisting of the President of the University, the Dean of the College of Engineering, and the professors of Mechanical Engineering, Experimental Engineering, Civil Engineering, Electrical Engineering, and Mathematics.

FEES AND EXPENSES

GENERAL CHARGES

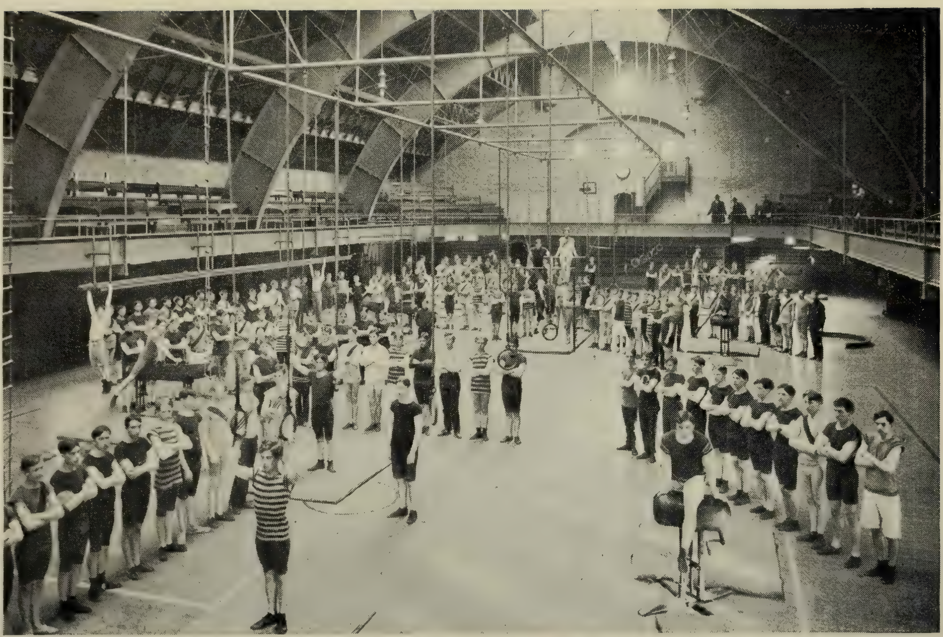
All term dues must be paid at the opening of each term as a condition of admission to classes.

INCIDENTAL FEE.—A charge of six dollars a term, or eighteen dollars a year, is made against all students, under the head of incidental expense. In the case of former students, if this fee is not paid until the second day of the term, one dollar will be added, and for each succeeding day of delinquency, fifty cents will be added.

TUITION.—Tuition is free in the College of Engineering.

LABORATORY FEES.—Students in all laboratory courses are required to pay a flat fee of one dollar per term for each laboratory course taken. The sums thus derived are to cover in part the loss and deterioration of the expensive

THE
JOHN CRERAR
LIBRARY



GYMNASIUM—INTERIOR.

instruments used by them. In addition, an effort is made in each department to assess upon the students of each laboratory course the cost of the supplies and materials consumed by them. These fees vary considerably in different departments, and they are generally collected in the form of cash advances when the student enters, the unexpended balance being returned to him at the end of the term.

In those departments where the laboratory work is chemical, the student buys a card for five dollars at the beginning of the course, and from that card is supplied with chemicals and apparatus as he needs them, the value of each purchase being punched out of the card at the time. When the card is exhausted, another must be purchased. The store room redeems all unused cards at face value. In addition, a deposit of five dollars is required as security against breakage or loss of the equipment of the desks, which is not supposed to be worn out or consumed, as in the case of chemicals.

Gymnasium Locker Fee.—A fee of one dollar a term is required from those who make use of a locker in the gymnasium.

Cadet Uniforms.—The uniform with which the members of the battalion are required to provide themselves costs (without overcoat) about fourteen dollars. It is quiet in pattern, and is designed to be worn in place of civilian dress.

Graduation Fee.—A fee of five dollars, to cover expense of graduation and diploma, is required of each person receiving one of the ordinary degrees from the University, and this fee must be paid before the degree is conferred. A like fee of ten dollars is charged to each person receiving one of the higher graduate degrees.

TOTAL AMOUNT OF FEES

The element of economy on the part of the student enters somewhat into the cost of pursuing laboratory courses. For this reason it is impossible to fix accurately the costs for a term or a year. In pursuing the courses of the College of Engineering it is not likely that a student could get through a year's work with an expenditure in fees of less than thirty ($30.00) dollars, nor is it likely that the amount would ever exceed fifty ($50.00) dollars, except in cases of fines being assessed for gross carelessness or needless destruction of property.

ROOMS AND BOARD

There are two dormitories on the University grounds for the use of students. Each occupant is charged by the University a rent of a dollar and a half a term.

The South Dormitory affords unfurnished rooms to such students as desire to board themselves, and thus to reduce their expenses to a minimum. The expense of living in this way is about two dollars per week. Applications for rooms should be made to the President of the University.

The North Dormitory will accommodate more than sixty students. Board, furnished rooms, fuel, light, and washing are, at present prices, supplied for about three dollars and twenty-five cents a week. Students will be admitted on special recommendation to the President of the University.

Boarding clubs are also formed in the neighborhood of the University. Furnished rooms are rented at seventy-five cents to one dollar a week for each student, and the cost of table board is two dollars to three dollars a week.

Board with furnished rooms can be obtained in private families, within convenient distances of the University, at rates varying from three and a half dollars to five dollars a week. The ruling rate may be taken as four dollars.

ESTIMATE OF EXPENSES

The expenses of a student in the University for a year may be estimated as follows, excluding clothing (except uniform) and traveling expenses:

	*Low	Average	High
Incidental fees	$ 18 00	$ 18 00	$ 18 00
Laboratory fees	15 00	30 00	54 00
Books and stationery	15 00	25 00	50 00
Room	4 50	45 00	75 00
Board	.....	126 00	180 00
Laundry	10 00	20 00	30 00
Miscellaneous	10 00	30 00	75 00
Uniform	14 00	14 00	14 00
Furniture	15 00	.....	.....
Food and supplies	75 00	.....	.....
	$176 50	$308 00	$496 00

SELF SUPPORT.—There is considerable amount of work upon the farm and in the shops and laboratories of the University which may be assigned to students on application. Preference is given to those studying Agriculture or one of the Engineering courses. *The University cannot promise work to all applicants.* Many students find work in private families, in offices and in various occupations, by means of which they defray at least a portion of their expenses. A person of ability and energy, who is master of a trade or who can do good work of any kind, can generally find remunerative employment. It has seldom been known that any student of ordinary energy and industry was obliged to leave the University because of a lack of money for necessary expenses, after having been sixty days on the ground—or long enough to inform himself as to the opportunities for securing employment. As an accommodation the executive office coöperates as far as possible in this matter. The Y. M. C. A. offers its services in helping young men to secure employment. Very much depends, however, on the individual's power of initiative. Students should not come to the University expecting others to find places for them. They should report to the executive office from time to time as to their needs and their work. This will enable the authorities to be more helpful than otherwise would be possible.

---

*Student renting unfurnished room and cooking for himself.

A student devoting much of his time to earning his way will be unable to carry successfully the full amount of collegiate work. Such students should apply for the privilege of carrying reduced work. This, of course, means that the time required to obtain a degree will be extended to five or more years, according to the amount of work successfully carried each year.

RELIGIOUS AND MORAL CULTURE

The Young Men's Christian Association endeavors to cultivate a healthy religious atmosphere in the University by holding weekly meetings, by promoting the study of the Bible and the progress of Christianity. In the 48 group classes for Bible study, 480 men, or almost one-third of the men in the University, have been enrolled this year. The home and headquarters of the Association is located at 136 West Tenth Avenue.

Prospective students are invited to write for the Student's Hand-Book of information concerning the University or for special information in regard to board, rooms, or employment to the General Secretary, O. S. U. Y. M. C. A., 136 West Tenth Avenue, Columbus, Ohio.

GENERAL INFORMATION

REGISTRATION.—All students are required to register and pay their term fees on or before the first day of each term between the hours of 8 a. m. and 12 m., or between 1 and 4 p. m., central standard time. No candidate for graduation will be permitted to register for the second term of his graduating year, except upon presentation to the Bursar of the President's certificate that his thesis subject has been announced and approved.

AMOUNT OF WORK.—No student is permitted to take less than fifteen credit hours a week of any sort of work, except by special permission, and no student will be permitted to take more than the regular work of the class to which he belongs, who has not passed all his work for the preceding term.

CREDIT HOURS.—"Two consecutive hours of practical or experimental work in any department shall be regarded as the equivalent of one hour of class-room exercise; but when no outside work is required in addition to the laboratory work, then three hours of laboratory work may be required as equivalent to one credit hour; and in general not more than three hours of the student's time, including class hours, shall be required for each credit hour."

CONSULTATION.—For consultation regarding work in any class or department, students will apply to the professor or instructor in charge.

For consultation in regard to their status as members of the College of Engineering, or for the filing of petitions, changes of course, changes of class cards, adjustment of schedules and similar needs, students will apply to the Secretary, Brown Hall, Room 31, from 9 to 10 a. m.

On matters connected with the discipline of the institution, students will apply to the President of the University.

PROBATION.—At the close of any term a student failing to pass in two-thirds of his work will be considered on probation for the next three terms; and a second similar failure incurred while thus on "probation" will forfeit his connection with the University.

ENROLLMENT*

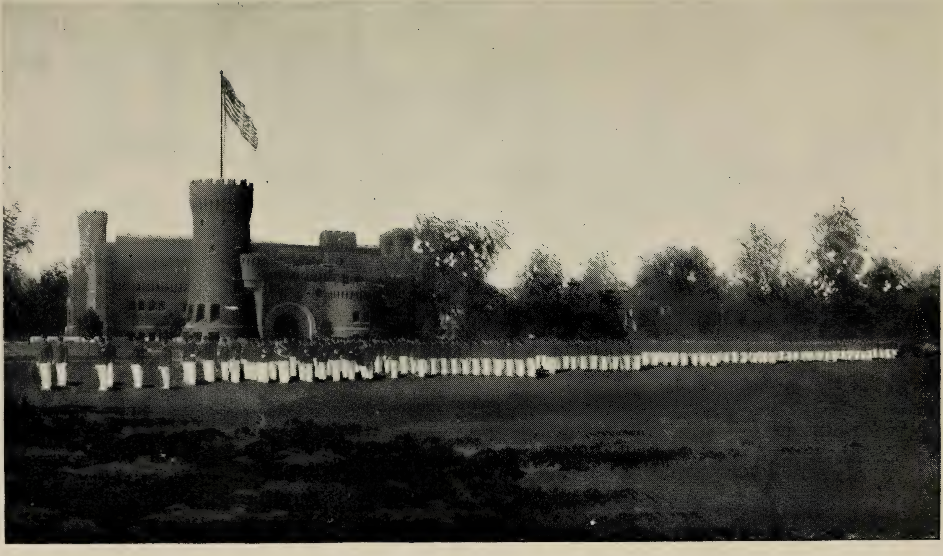
March 6, 1906.

STUDENTS IN FOUR-YEAR COURSES LEADING TO DEGREES	718
STUDENTS IN SHORT COURSES NOT LEADING TO DEGREES	51
SPECIAL STUDENTS	22
Total	791

CLASSIFICATION BY COURSES

Name of Course Pursued	4th year	3rd year	2nd year	1st year	2nd yr. short	1st yr. short	Special	Total
Unclassified	....	....	....	264		....	....	264
Architecture	....	5	6	Unclassified	....	....	....	11
Ceramics	....	6	18		9	12	....	45
Chemical Engineering	3	6	17		....	....	....	26
Civil Engineering	20	40	66		..	....	....	126
Electrical Engineering	25	45	68		....	....	....	138
Industrial Arts	1	1	2		5	13	....	22
Manual Training	....	....	1		....	....	....	1
Mechanical Engineering	17	24	35		....	....	....	76
Mine Engineering	13	16	19		3	9	....	60
Special, Unclassified	....	....	....		....	....	22	22
Total	79	143	232	264	17	34	22	791

NOTE:—For list of names, consult the General Catalogue of the University, which will be sent on application.



UNIVERSITY REGIMENT.

SUMMARY OF GRADUATES

Architecture (C. E. in Arch.)	4
Ceramics (E. M. in Ceramics)	10
Chemistry (B. Sc. in Chemistry)	24
Civil Engineering (C. E.)	149
Electrical Engineering (M. E. in E. E.)	155
Industrial Arts (B. Sc. in Ind. Arts)	2
Mechanical Engineering (M. E.)	124
Mining Engineering (E. M.)	76
Master of Science, Conferred by College of Engineering	2
Total Degrees Conferred	546
Names Counted Twice	8
Total Number of Graduates	538

DIRECTORY OF GRADUATES

March 6, 1906.

The faculty of the college of Engineering are anxious to place a copy of each annual catalogue in the hands of their graduates. They will esteem it a favor if any alumnus who changes his residenc will notify the Secretary of the University Faculty of the new address and occupation. They will also be grateful for any information from any source that may assist in making or keeping the Directory of the Alumni complete and corerct.

A

Ackerman, Eli O., 1884, C. E. Station "B," Columbus, Ohio.	Engineer, Maintenance of Way Columbus Railway & Light Co.
Ackerman, Fremont, 1883, C. E. Los Angeles, California.	Civil Engineer.
Aldrich, Edgar S., 1897, E. E. Moscow, Idaho.	Vice President and Manager Moscow Electric Light & Power Co.
Alexander, C. P., 1896, E. E. Canton, Ohio.	Instructor in Physics, Canton High School.
Alexander, St. C., 1893, E. E. Kansas City, Mo.	In Stock Yards.
Alsdorf, Fred C., 1892, E. M. Clifton, Arizona.	Superintendent, Stevens Copper Co.

Alsdorf, Percy Reed, 1896, E. M. Central City, Colorado.	In Standard Assay Office.
Alsdorf, Robert C., 1904, M. E. Huntington, W. Va.	In Motive Power Dept., C. & O. R. R.
Ames, Edward H., 1903, C. E. Columbus, Ohio.	Transitman, City Engineer's Office.
Arnold, Edwin E., 1898, M. E. East Pittsburg, Pa.	Engineer, Westinghouse Machine Company.
Asher, Clyde B., 1905, C. E. Pittsburgh, Pa.	With Pennsylvania Lines.
Atkinson, Warren, 1899, M. E. Brooklyn, N. Y.	Maintenance Dept., New York Telephone Co.
Auld, James A., 1897, E. E. Columbus, Ohio.	With D. L. Auld.

B

Bailey, Ervin G., 1903, M. E. Fairmount, W. Va.	With Fairmount Coal Co.
Barcus, Miner, 1897, E. E. Schenectady, N. Y.	Assistant Engineering Dept., General Electric Co.
Barienbrock, Chas. H., 1905, C. E. Mt. Vernon, Ohio.	With Mt. Vernon Bridge Co.
Barnaby, C. L., 1898, C. E. Fort Wayne, Ind.	Engineer Maintenance of Way Dept., G. R. & I. Ry.
Barringer, L. E., 1902, E. M. Schenectady, N. Y.	In Research Dept., General Electric Co.
Barrows, Harry H., 1898, C. E. Lexington, Ky.	Division Engineer, Q. & C. Route.
Barry, William J., 1903, C. E. Doanville, Ohio.	Chief Engineer, Columbus & Hocking Coal & Iron Co.
Beach, David Price, 1895, C. E. Zanesville, Ohio.	Engineer Maintenance of Way, C. & M. V. Ry.
Beach, Howard L., 1904, E. E. Pittsburg, Pa.	In Testing Dept., Westinghouse Elec. Mfg. Co.
Bebout, Guy B., 1905, C. E. Columbus, Ohio.	In City Engineer's Office.
Beck, Arthur A., 1893, C. E. Columbus, Ohio.	Assistant City Engineer.
Belden, Sanford B., 1895, E. M. Pittsburg, Pa.	Manager Pittsburg Office, Jeffrey Manufacturing Co.
Bell, Wakeman C., 1905, C. E. Pittsburg, Pa.	Asst. on Engineering Corps, P., C., C. & St. L. Ry.
Benedict, E. W., 1904, E. E. Columbus, Ohio.	With Col. Ry. & Light Co.
Biebel, Herman M., 1896, E. E. Hawthorn, Ill.	Electric Engineer, Western Electric Co.
Bischoff, John W., 1899, E. M. Washington, D. C.	322 I Street, S. W.
Bissing, William, 1893, E. E. 49 Wall St., New York City.	Patent Attorney.

Blackburn, F. H., 1896, E. E... St. Louis, Mo.	Superintendent, Columbia Incandescent Lamp Co.
Bleininger, A. V., 1901, B. Sc.. Columbus, Ohio.	Assistant Professor of Ceramics, Ohio State University.
Bloom, J. George, 1899, C. E... Topeka, Kas.	Engineer Maintenance of Way, C. R. I. & P. Ry
Boehme, Adolph J., 1901, M. E.. Youngstown, Ohio.	Engineer with the Youngstown Iron Sheet and Tube Company.
Bone, E. P., 1905, E. E........ Walnut Hills, Cincinnati, O.	
Bostater, H. L., 1904, E. E...... Dayton, Ohio.	With The National Cash Register Co.
Bomesberger, W. N., 1903, E. M. Byesville, Ohio.	With Willes Creek Coal Co.
Boothman, Dale R., 1903, M. E. Mingo Junction, Ohio.	With Carnegie Steel Co.
Bostwick, Oliver N., 1902, C. E. Mt. Sterling, Ohio.	Civil Engineer.
Bott, George R., 1901, M. E.... Indianapolis, Ind.	Engineer in charge of Automobile Production, Nordyke & Marmon Co
Bowden, Harry W., 1900, C. E.. Mt. Vernon, Ohio.	Draftsman, Mt. Vernon Bridge Company.
Bower, Jerome G., 1897, M. E... Chicago, Ill.	Sales Agent, Pressed Steel Car Co.
Bradford, Joseph N., 1883, M. E. Columbus, Ohio.	Professor of Architecture and Drawing, Ohio State University.
Brannon, T. H., 1903, C. E.... Columbus, Ohio.	Asst. City Engineer.
Brashear, E. R., 1903, C. E.... Mt. Vernon, Ohio.	Draftsman Mt. Vernon Bridge Works.
Bridgman, B. L., 1904, C. E.... Columbus, Ohio.	Assistant on Engineer Corps, Hocking Valley R. R.
Britton, Guy, 1904, C. E...... Columbus, Ohio.	Asst., City Engineer's Office.
Britton, Lloyd C., 1902, C. E.... Miami, Fla.	Asst. Engineer, Florida East Coast Ry.
Brooks, Herbert B., 1903, E. E.. Washington, D. C.	Asst. Physicist Bureau of Standards.
Brophy, James F., 1899, E. M.. Frostburg, Md.	
Brown, Fred W., 1888, E. M.... Portland, Col.	Chemist, The Portland Cement Co.
Brown, John Q., 1898, M. E... Oakland, Cal.	Asst. General Manager and Engineer, Oakland Transit Co., and San Francisco, Oakland & St. Jose R. R.

Brown, Newton H., 1893, E. E. College Station, Tex.	Professor of Physics and Electrical Engineering, A. & M. College, Texas.
Brumley, Daniel J., 1895, C. E. Chicago, Ill.	Prin. Asst. Engineer, Illinois Central R. R.
Bruning, Henry D., 1896, C. E. Columbus, Ohio.	Manager National Engineering Company.
Buchenberg, A. E., 1900, E. E. Sandusky, Ohio.	Chief Electrical Engineer, Warren Electric Mfg. Co.
Buckman, A. L., 1897, E. E. Toledo, Ohio.	Superintendent of Equipment, Toledo Home Telephone Co.
Burnham, L. H., 1905, E. E. Pittsfield, Mass.	With Stanley Electric Co.
Burns, James F., 1891, C. E. Elizabethtown, Ky.	Engineer, Louisville & Nashville R. R.
Burrell, Glenn S., 1904, C. E. Mt. Vernon, Ohio.	In Mt. Vernon Bridge Works.
Bygate, Harry G., 1899, M. E. Niagara Falls, N. Y.	Asst. Superintendent, Upper Works, Pittsburg Reduction Co.

C

Calkins, George H., 1895, E. E. 44 Broad St., New York City.	Engineer and Salesman, General Electric Co.
Cameron, Harry E., 1901, C. E. Wilkinsburg, Pa.	In Designing and Estimating Dept., McClintic Marshall Construction Co.
Cameron, Gaylor M., 1904, E. E. Cleveland, Ohio.	In Engineering Dept., Cleveland Electric Ry. Co.
Capron, M. F., 1888, M. E. Detroit, Mich.	Chief Mechanical Engineer, Seamless Steel Tube Co.
Carr, Hugh Stanley, 1896, E. E. Constantine, Mich.	Electrical Engineer, American Carbolite Co.
Carroll, Patrick H., 1894, E. M. Herrin, Illinois.	Superintendent, Big Muddy Coal & Iron Co.
Carson, Samuel K., 1895, E. E. Washington, D. C.	Acting Assistant Surgeon, U. S. A.
Cartzdafner, R. E., 1903, M. E. Columbus, Ohio.	With Jeffrey Mfg. Co.
Cavanaugh, A. F., 1900, M. E. Milwaukee, Wis.	Draftsman, F. M. Prescott Steam Pump Co.
Cavin, Frank T., 1902, E. E. Schenectady, N. Y.	With General Electric Co.
Cellarius, Fred J., 1888, C. E. Dayton, Ohio.	Assistant City Engineer.
Chaffin, W. W., 1904, C. E. Columbus, Ohio.	Assistant on Engineer Corps, Indianapolis Div. Pa. Lines.
Chambers, Wm. R., 1904, M. E. Lynn, Mass.	In Testing Dept., General Electric Co.

Chappell, Walter E., 1898, E. E. Trafford Pk., Manchester, Eng.	With the British Westinghouse Electric Co. L't'd.
Chubb, C. St. J., 1904, C. E...... (Arch,) Columbus, Ohio.	Draftsman with F. L. Packard, Architect.
Chubb, Joseph H., 1904, C. E... Columbus, Ohio.	
Chubb, L. W., 1905, E. E...... Pittsburg, Pa.	With Westinghouse E. & M. Company.
Cilley, Raymond, 1896, M. E... Middletown, Conn.	Chief Draftsman, Eisenhoth Horseless Vehicle Co.
Clark, Thomas W., 1904, E. M., (Cer.) New Brunswick, N. J.	With the Reconstructed Granite Co.
Clarke, C. J., 1899, C. E........ Columbus, Ohio.	Draftsman, City Engineer's Office.
Clarke, James U., 1902, E. E... Lancaster, Ohio.	Supt. Lancaster Traction Co.
Coddington, E. F., 1896, C. E., 1897, M. Sc.; 1902, Ph. D. University of Berlin. Columbus, Ohio.	Asst. Professor of Mathematics, Ohio State University.
Cole, George N., 1891, E. E.... 277 Broadway, N. Y. City.	Mfg. Cross, Horizontal, Folding and other Warehouse Doors.
Collins, Curtis, 1895, E. E.... San Juan, Porto Rico.	Consulting Engineer for S. A. Luz Electrica and Rio Electric Co.
Conley, Clyde G., 1902, C. E... Mt. Vernon, Ohio.	Draughtsman, Mt. Vernon Bridge Co.
Connell, Wm. A., 1886, E. M.. Kansas City, Mo.	In Medical College.
Conrad, Herman W., 1905, M. E. Tiffin, Ohio.	
Conrad, Louis Verne, 1902, C. E. Pittsburg, Pa.	Asst. on Engineers' Corps, P., C., C. & St. L. R. R.
Conway, Hugh L., 1896, C. E... Cincinnati, Ohio.	Assistant City Engineer.
Cook, Spencer N., 1903, E. M... Des Moines, Iowa.	Superintendent, Smith-Lowe Coal Co.
Cooper, S. D., 1905, E. E........ Pittsburg, Pa.	With Westinghouse E. & M. Company.
Cope, Albert N., 1897, E. E.... Columbus, Ohio.	Chief Electrician, Columbus Public Service Co.
Cosley, Harvey H., 1901, C. E... Chicago, Illinois.	Salesman, Cambria Steel Co.
Coulter, Leonard B., 1904, E. M. (Cer.) Columbus, Ohio.	With Prof. Edward Orton, Jr., Clay Testing and Mfg. Clay Specialties.

COVELL, VERNON R., 1895, C. E.. Pittsburg, Pa.	Supt. Penn. Light, Heat & Power Co.
CRABLE, ARTHUR, 1901, C. E.... Huntington, Ind.	Division Engineer, Erie Ry. Company.
CRAFT, F M., 1905, E. E........ Chicago, Ill.	With Western Electric Co.
CROCKER, T. D., 1904, E. E...... Milwaukee, Wis.	With Electric Ry. & Light Co.
CROOKS, THOMAS E., 1904, M. E.. Lynn, Mass.	In Testing Dept., General Electric Co.
CUNNINGHAM, E W., 1894, C. E. Ambridge, Pa.	With American Bridge Co.
CUNNINGHAM, R. H., 1905, M. E. Cleveland, Ohio.	
CURRAN, MICHAEL F., 1905, C. E. Corning, Ohio.	
CURTIS, LEIGH G., 1899, C. E... Chicago, Illinois.	Division Engineer, Chicago Division, B. & O. R. R.

D

DAMRON, CARSON W., 1897, M. E. Pittsburg, Pa.	Asst. Engineer, Bollinger Andrews Construction Co.
DANN, WALTER M., 1902, E. E... Pittsburg, Pa.	With Westinghouse Electric & Manufacturing Co.
DAVIS, CHARLES W., 1894, E. M. Colorado Springs, Col.	Investments.
DAVIS, OSCAR ALLEN, 1897, E. E. Alliance, Ohio.	Mechanical Engineer, Reeves Bros. Co.
DEAHL, WALTER S., 1896, C. E... Johnstown, Pa.	Draftsman, Cambria Steel Co.
DELOFFRE, ANDRE, 1896, E. E... London, E. C., England.	Electrical Engineer for General Electric Co. of America.
DENNY, CHAS. W., 1901, E. E.. 220 W. 29th, New York, N. Y.	In Experimental Department Cooper Hewitt Electric Co.
DEWOLF, R. D., 1901, E. E...... Pittsburg, Pa.	Electric Engineer, Westinghouse Electric & Manufacturing Co.
DIEMER, HUGO, 1896, E. E....... Indianapolis, Ind.	Consulting Engineer.
DILL, RAYMOND, 1901, E. E...... Norwood, Ohio.	In Bullock Works, Allis-Chalmers Co.
DONHAM, M. D., 1896, M. E.... Warren, Pa.	Supt. of Agents, Nat. Life Ins. Co., of Vermont.
DORSEY, WALTER A., 1904, M. E.. Lynn, Mass.	In Testing Dept., General Electric Co.
DOTY, OLIVER P., JR., 1904, E. M. Hanging Rock, Ohio.	

Drummond, Wm. G., 1900, M. E. College Station, Texas.	Asst. Professor of Mechanical Engineering, A. & M. College of Texas.
Dun, John J., 1883, E. M. Columbus, Ohio.	Consulting Engineer.
Dunlap, T. C., 1895, E. E. Columbus, Ohio.	Manager Columbus Pneumatic Tool Co.
Dunlop, Robert R., 1900, E. E. Columbus, Ohio.	Electrical Engineer, Jeffrey Manufacturing Co.
Dunnick, Edward, 1897, C. E. Cincinnati, Ohio.	With Brackett Bridge Co.
Dupuy, B. F., 1904, C. E. Clio, California.	Asst. Engr., Western Pacific Railway.

F

Emswiler, John E., 1903, M. E. Schenectady, N. Y.	In Steam Turbine Dept., General Electric Co.
Erskine, James H., 1886, E. M., M. D. Albany, Oregon.	Physician and Surgeon.
Estep, Frank L., 1898, E. E. Detroit, Mich.	Asst. Supt., Detroit Copper & Brass Rolling Mills.
Evans, Peter P., 1892, C. E. Osborn Bldg., Cleveland, O.	Contracting Engineer, The Osborn Engineering Co.
Eysenbach, E. E., 1896, E. M. Binghamton, N. Y.	Gen'l. Mgr. Binghamton Gas Company.

E

Feicht, Edward R., 1904, M. E. Pittsburg, Pa.	With Westinghouse Machine Company.
Feicht. Russell S.. 1890. E. E. Pittsburg, Pa.	Head of Industrial Division, Engineering Dept., Westinghouse Electric & Mfg. Co.
Fergus, Guy C., 1898, E. E. Zanesville, Ohio.	Partner, Zanesville Electric Company.
Fickes, Walter M., 1900, E. M. Carnegie, Pa.	Manager of the Rosslyn Brick Company.
Fish, Fred Alan, 1898, E. E. Ames, Iowa.	Associate Professor of Electrical Engineering, Iowa State College.
Floto, Julius, 1889, E. M. Chicago, Ill.	Agent, Brown-Ketcham Iron Works of Indianapolis.
Flowers, Dean W., 1905, E. M. Bennington, N. Y.	With the Bennington Gas Co.
Flynn, Harry F., 1892, C. E. Manila, P. I.	Chief Surveyor, Bureau of Public Lands.
Ford, Nile Otis, E. M., 1897, A. B.; 1900, M. S. San Francisco, Cal.	Asst. Manager, Herring-Hall-Marvin Safe Co.

Foster, Frank M., 1894, E. E.... Cincinnati, Ohio.	Secretary and Treasurer, American Valve and Meter Company.
Foster, Vause, 1903, E. M...... Chillicothe, Ohio.	Deputy Co. Surveyor.
Fowler, Harry R., 1894, E. E... Toledo, Ohio.	Electrical Engineer and Contractor.
Fox, John Herbert, 1897, M. E.. Cleveland, Ohio.	Frazier, Fox & Spencer.
Frame, Rollo S., 1901, C. E..... Pittsburg, Pa.	Asst. on Engineers' Corps, Penn. Lines.
Frankenberg, G. T., 1902, M. E. Columbus, Ohio.	Asst. Master Mechanic, Columbus Iron & Steel Co.
Frankenberg, J. T., 1899, E. E.. Boston, Mass.	Telephone Engineer.
Fravel, George B., 1888, M. E.... Chicago, Ill.	Master Mechanic, Chicago Terminal Division, Penn. Lines.
Frayer, Lee A., 1896, M. E...... Columbus, Ohio.	Of Frayer & Miller, Motor Cycles.
Frechtling, Arthur, 1901, M. E. Hamilton, Ohio.	
Freeman, S. S., 1898, E. M...... Parryville, Pa.	Blast Furnace Manager, Carbon Iron & Steel Co.
French, Thomas E., 1895, M. E. Columbus, Ohio.	Associate Professor of Architecture and Drawing, Ohio State University.
Frost, George W., 1900, M. E... Dayton, Ohio.	With the Dayton Electric Co.
Fuller, Charles W., 1904, E. M. Copper Mountain, Alaska.	Metallurgist.

G

Gallen, William F., 1897, M. E. Columbus, Ohio.	Foreman of Drafting Room, Case Manufacturing Co.
Gamper, Herman, 1899, M. E... Xenia, Ohio.	Superintendent, Mechanical and Electrical Dept., O. S. & S. O. Home.
Garber, John M., 1897, C. E.... Wheeling, W. Va.	Chief Draftsman, W. Va. Bridge & Construction Co.
Gee, Eugene C., 1897, E. E...... Manila, P. I.	Gen. Manager, Philippine Island Tel. and Tel. Co.,
Gehrkens, E. F., 1894, E. E..... Schenectady, N. Y.	With General Electric Co.
Given, James Byron, 1896, E. E. Chicago, Ill.	In Telephone Dept., Western Electric Co.
Goddard, Loring H., 1892, C. E.. R. F. D. No. 5, Washington C. H., Ohio.	Farmer.

Goodell, Ralph S., 1892, C. E.. Mt. Vernon, Ohio.	Principal Assistant Engineer, Mt. Vernon Bridge Co.
Gould, Wm. S., 1904, M. E...... Lynn, Mass.	In Steam Turbine Testing Dept., Gen. Electric Co.
Graham, Emery E., 1898, E. E.. Cleveland, Ohio.	Draftsman, Wellman-Seaver-Morgan Engineering Co.
Grate, Charles A., 1898, M. E.. Cleveland, Ohio.	With Interstate Engineering Company.
Green, Jerome J., 1893, E. E.... Notre Dame, Indiana.	Professor of Physics and Electrical Engineering, University of Notre Dame.
Green, Joseph F., 1890, E. E.... Moline, Illinois.	Electrical Engineer, Moline Elec. Elev. Co.
Gregory, Hiram D., 1880, E. M.. Covington, Ky.	Attorney-at-Law.
Griffin, Mark H., 1897, E. E... Spitzer Bldg., Toledo, Ohio.	Real Estate Agent.
Groves, John W., 1898, C. E.... Carbon, W. Va.	Superintendent Republic Coal Company.
Guiss, Charles A., 1905, C. E... New Washington, Ohio.	
Gwynne, Josiah W., 1904, E. E.. Pittsburg, Pa.	In Testing Dept., Westinghouse Elec. & Mfg. Co.

H

Haas, Frank, 1895, C. E., 1896, E. M. Fairmount, W. Va.	Chemist, Fairmount Coal Co.
Hackney, W. W., 1905, M. E.... Fort Wayne, Ind.	With Western Car Construction Co.
Hagemeyer, Earl P., 1905, C. E.. Cincinnati, Ohio.	
Hale, Frederick J., 1898, M. E.; 1900, M. Sc. Pittsburg, Pa.	Asst. Foreman, Westinghouse Machine Co., Gas Engine Department.
Hall, Harry R., 1889, E. M.... Sault Ste. Marie, Ont., Can.	Supt. Blast Furnaces, The Lake Superior Power Co.
Hamilton, Ross E., 1903, C. E.. Stewartsville, Va.	Transitman, Deepwater Ry.
Hammond, John M., 1902, C. E.. Dunkirk, N. Y.	Assistant in Eng. Dept., L. S. & M. S. Ry.
Hammond, C. E., 1905, E. E..... 4731 S. Atlanta St., Pittsburg, Pa.	
Hance, Harry T., 1901, B. Sc. (Chem.) Columbus, Ohio.	Sec.-Treas. of Hance-Brown Casting Co.

Harrington, A. L., 1905, E. E... 706 Whitney Ave., Wilkinsburg, Pa.	With Pittsburg Office, General Electric Co.
Hapgood, Eugene P., 1902, B. Sc. Salt Lake City, Utah.	Assistant, Maintenance of Way Dept., S. P. L. & S. L. R. R.
Hardy, Paul, 1904, E. M........ 46 S. Sixth St., Columbus, O.	
Harkins, Robert R., 1900, M. E. Pittsburg, Pa.	Manager Pittsburg Office, Atlas Engine Co.
Harrison, Wm. H., 1885, C. E... Columbus, Ohio.	Railway Engineer.
Harrop, Carl B., 1902, E. M.... Columbus, Ohio.	Secretary, Scott Kiln Drying Company.
Hartwell, Arthur, 1888, M. E.. Pittsburg, Pa.	Sales Manager, Westinghouse Electric & Mfg. Co.
Hartwick, Louis M., 1897, M. E. Pueblo, Col.	Master Mechanic, Blast Furnace, C. F. & I. Co.
Hassler, Robert H., 1892, E. E.. Indianapolis, Ind.	Engineer, International Motor Car Co.
Hawthorne, Carl H., 1905, C. E. Kansas City, Mo.	In Railroad Engineering Work.
Hayman, Wm. C., 1900, E. E... Schenectady, N. Y.	Engineer, Wire & Cable Dept., General Electric Co.
Hayward, George E., 1893, C. E.. Bronson, Mich.	Secy.-Treas., American Truss Post Co.
Hazlett, Robert, Jr., 1887, C. E.. Wheeling, W. Va.	Consulting Civil Engineer, and Chief Engineer, Pan Handle Traction Co.
Hebble, Charles R., 1896, E. E.. Cincinnati, Ohio.	Special Agent, Penn Mutual Life Insurance Co.
Heller, Albert H., 1890, C. E... Columbus, Ohio.	Died February 20, 1906.
Helvey, George S., 1903, M. E... Chicago, Ill.	
Henderson, A. A., 1898, C. E... Pittsburg, Pa.	Asst. County Engineer.
Henrietta, Chas. M., 1896, E. M. Bauff, Alberta.	In Mining and Metallurgical Dept., Canadian Pacific R. R.
Hepner, C. R., 1905, E. E....... Cleveland, Ohio.	With Lincoln Electric Co.
Hertner, John H., 1899, E. E.. Cleveland, Ohio.	Of Hertner Electric Co.
Hewitt, S. R., 1898, E. E....... Columbus, Ohio.	With Kinnear Mfg. Co.
Hill, Cortland L., 1903, C. E.. Columbus, Ohio.	Assistant in City Engineer's Office.
Hine, Lucius A., 1888, E. M.... Chicago, Ill.	President and Treasurer, Hine-Watt Manufacturing Co.
Hipple, John M., 1893, E. E.... Pittsburg, Pa.	Engineer, Westinghouse Electric & Mfg. Co.

Hirsch, Gustav, 1897, E. E. **Lima, Ohio.**	Chief Engineer and Vice President, Ideal Construction Co.
Hirst, Harry, 1903, E. M. **Dennison, Ohio.**	Superintendent, Dennison Mining Co.
Hitch, James F., 1902, C. E. **Williamson, W. Va.**	Engineer, Ohio & Big Sandy Coal Co.
Hite, Florence E., 1904, C. E. **Columbus, Ohio.**	Draftsman with J. A. Jones, Architect.
Hobbs, Caleb, 1905, E. E. **Schenectady, N. Y.**	With General Electric Co.
Holbrook, George F., 1902, E. M. **Hollywood, Cal.**	Surveyor, with City Engineer.
Holloway, T. W., 1904, M. E. **Scranton, Pa.**	With International Correspondence Schools.
Homan, Frank, 1895, C. E. **Carbon, W. Va.**	Superintendent Republic Coal Company.
Hood, Willard J., 1904, M. E. **Huntington, W. Va.**	In Motive Power Dept., C. & O. R. R.
Hope, H. L., 1905, E. E. **Chicago, Ill.**	With Western Electric Co.
Hopkins, Lloyd C., 1905, M. E. **Columbus, Ohio.**	Asst. Ohio State University.
Howald, Ferd., 1878, B. Sc.; 1881, E. M. **Rush Run, Fayette, W. Va.**	Coal Operator.
Howe, Roy E., 1904, C. E. **Roosevelt, Idaho.**	Assayer.
Howells, E. S., 1884, E. M. **Birmingham, Ala.**	President, Howells Mining Co.
Howells, T. J., 1897, E. M. **Bluefield, W. Va.**	Chemist in Pocahontas Coal Field for National Steel Co.
Huddleson, F. N., 1902, E. M. **Salt Lake City, Utah.**	In Maintenance of Way Dept., S. P., L. Q. & S. L. Ry.
Hull, Walter A., 1902, E. M. (Cer.) **Drummond, Pa.**	General Manager, Shawmut Clay Mfg. Co.
Humphrey, H. P., 1904, E. M., (Cer.) **Bradford, Pa.**	Vice President Northeastern Terra Cotta Co.
Hunt, Wm. F., 1887, M. E.; 1895, LL. B.; 1896, LL. M. (Univ. of Minn.) **St. Paul, Minn.**	Attorney-at-Law.
Hunter, James W., 1904, C. E. **Salem, Ill.**	Asst. Engr., C. & E. I. R. R.
Hunter, Madone C., 1900, E. E. **St. Joseph, Mo.**	Chief Engineer, St. Joseph Ry., Light, Heat & Power Co.
Huntington, A., 1899, M. E. **Sioux Falls, S. Dak.**	Pres. Cascade Milling Co.

Hyle, Charles A., 1896, E. E... Minneapolis, Minn.	Observer, U. S. Weather Bureau.

I

Iancu, Joseph, 1905, E. E...... Schenectady, N. Y.	With General Electric Co.
Ireland, Guy L., 1895, M. E....	
Irvin, Chadwick H., 1897, M. E. Pueblo, Col.	Draftsman, Colorado Fuel & Iron Co.

J

Jacobi, Jacob A., 1905, C. E..... Greenville, Ohio.	
Jeannot, Frederick C., 1905, M.E. Chicago, Ill.	With Western Electric Co.
Jenkins, William G., 1893, C. E. Bellefontaine, Ohio.	Draftsman, The Bellefontaine Bridge & Iron Co.
Jenkins, Willis H., 1894, C. E.. Sheridanville, Pa.	Transitman, Penn. Lines West of Pittsburg.
Jennings, Levi E., 1897, E. E... Dayton, Ohio.	With R. E. Kline, Consulting Engineer.
Johnson, Chas. W., 1896, E. E.. Montreal, Canada.	General Superintendent Allis-Chalmers Bullock Co., Ltd.
Johnson, Earl S., 1900, E. E.... Schenectady, N. Y.	In Testing Department, General Electric Co.
Johnson, Walter A., 1902, M. E. Columbus, Ohio.	In Motive Power Dept., P., C., C. & St. L. Ry.
Johnston, George E., 1892, C. E. Louisville, Ky.	Assistant Engineer, L. & N. R. R.
Johnston, H. L., 1892, E. E.... Troy, Ohio.	Manager Hobart Electric Co.
Jones, Arthur J., 1898, E. E.... Pittsburg, Pa.	Foreman, Testing Dept., Westinghouse Electric & Mfg. Co.
Jones, Houston, 1895, E. E...... 604 Burlington Bldg., St. Louis, Mo.	Consulting Engineer.
Jones, Grandville R., 1904, C. E. Columbus, Ohio.	Student in Sanitary Engineering, Mass. Inst. of Technology, Boston.
Jones, Pearl N., 1892, E. E..... Pittsburg, Pa.	Chief Engineer, Pittsburg Ry. Company.
Jones, Smilie, 1894, E. M....... Prescott, Arizona.	
Judd, Horace, 1897, M. E.; 1899, M. Sc. Columbus, Ohio.	Assistant Professor in Experimental Engineering, Ohio State University.
Judson, Walter R., 1903, M. E.. Santa Barbara, Chihauhau, Mexico.	With Montezuma Lead Co.

K

Kalb, Warren C., 1904, E. E. Columbus, Ohio.	Mechanical Engineering, Columbus Pneumatic Tool Co.
Kanmacher, S. H., 1900, E. E. Schenectady, N. Y.	Engineer, Power & Mining Eng. Dept., Gen. Electric Co.
Keating, H. T., 1902, B. Sc. (Chem.) Columbus, Ohio.	Studying Law.
Keffer, Frederick, 1892, E. M. Greenwood, British Col.	General Manager, The British Columbia Copper Co., Ltd.
Kempton, W. H., 1905, E. E. Pittsburg, Pa.	With Westinghouse Eng. & Mfg. Co.
Kemmler, E. A., 1888, C. E. Columbus, Ohio.	Assistant City Engineer.
Kern, William F., 1902, B. Sc. (Chem.) Columbus, Ohio.	Chemist, Buckeye Steel Casting Co.
Kerr, Samuel T., 1894, E. E. Martins Ferry, Ohio.	Supt., Municipal Electric Light Plant.
Kester, Frederick E., 1895, E. E.; 1905, Ph. D. (Cornell). Columbus, Ohio.	Associate Professor of Physics, Ohio State University.
Kettering, Chas. F., 1904, E. E. Dayton, Ohio.	Chief of Electrical Invention Dept., National Cash Register Co.
Kettler, Frank C., 1901, C. E. Chicago, Ill.	In North Works, Illinois Steel Company.
Kiesewetter, L. F., 1891, C. E.; 1892, A. B. and 1893, A. M., (Harv.) Columbus, Ohio.	Cashier, The Ohio National Bank.
King, Herbert S., 1901, C. E. Springfield, Ill.	Engineer of Construction, Springfield Colliery Co.
King, Roy S., 1892, M. E. Columbus, Ohio.	Assistant Professor of Experimental Engineering, Ohio State University.
Klie, Walter, 1903, M. E. Columbus, Ohio.	With Klie Plumbing Co.
Kline, Charles H., 1897, E. E. Dayton, Ohio.	Civil Engineering, with R. E. Kline, Consulting Engineer.
Knecht, Arthur E., 1898, M. E. Cincinnati, Ohio.	Mechanical Engineer, Cincinnati Screw and Tap Co.
Knight, Wm. Abner, 1900, M. E. Columbus, Ohio.	Assistant Professor of Machine-Shop Practice, Ohio State University.
Knopf, C. S., 1905, E. E. Columbus, Ohio.	Machinist, Elec. Eng. Dept., Ohio State University.
Knox, Frank S., Jr., 1900, E. M. Buchtel, Ohio.	Engineer, Pittsburg Coal Co.

Krumm, Louis R., 1898, E. E. Columbus, Ohio.	With Erner-Hopkins Co.
Krumm, Thomas Z., 1902, C. E. Fort Dodge, Iowa.	Instrument Man, C. & G. W. R. R.
Kuenzel, Oscar, 1905, M.E. Dennison, Ohio.	In Penn. R. R. Shops.
Kuhn, Vallie H., 1896, E. E. Etna, Ohio.	Machinist.
Kunkle, Fred. R., 1903, E. E. Pittsburg, Pa.	Electrical Engineer, Westinghouse Elec. & Mfg. Co.

L

Lamb, Whitney E., 1900, E. E. Commercial Pt., Ohio.	Farmer and Stockman.
Lamme, Benjamin G., 1888, M. E Pittsburg, Pa.	Chief Engineer, Westinghouse Electrical & Mfg. Co.
Lamme, Bertha A., 1893, E. E. Pittsburg, Pa.	With Westinghouse Electric & Mfg. Co.
Landahl, Eugene E., 1905, E. M. Columbus, Ohio.	With The Jeffrey Mfg. Co.
Layman, Frank E., 1905 Alexandria, Va.	With Hydraulic Press Brick Company.
Laylin, David T., 1905, M. E. Kansas City, Mo.	With Western Electric Co.
Lake, Lewis J., 1905 Mt. Vernon, Ohio.	With Mt. Vernon Bridge Co.
Large, Joseph H., 1890, C. E. Massillon, Ohio.	Draftsman, Massillon Bridge Company.
Lee, Corliss Edgar, 1900, E. E. Schenectady, N. Y.	With General Electric Co.
Lee, Robert M., 1897, M. E. Washington, D. C.	Draftsman, Ordnance Dept., U. S. Army.
Leibold, Carl P., 1904, E. E. Columbus, Ohio.	Post Graduate Student at Ohio State University.
Lesh, John Howard, 1901, M. E. Bedford, Ohio.	Chief Draftsman, Interstate Engineering Co.
Levering, O. D., 1893, M. E. Columbus, Ohio.	Manufacturer Wall Ties.
Lincoln, Paul M., 1892, E. E. Pittsburg, Pa.	Head of Power Div., Engineering Dept., Westinghouse Electric & Mfg. Co.
Linebaugh, Jesse J., 1899, E. E. Schenectady, N. Y.	Electrical Engineer, Testing Department, Gen. Elec. Co.
Linville, C. P., 1900, B. Sc. (Chem.) 1902, A. M. State College, Pa.	Instructor in Metallurgy, Pennsylvania State College.

Logan, L. L., 1896, E. M........ Robertsdale, Pa.	General Superintendent, Rockhill Iron & Coal Co.
Long, George G., 1903, E. M..... Gary, McDowell Co., W. Va.	With Engineering Dept., U. S. Coal & Coke Co.
Lott, Charles M., 1895, E. E.... Hicksville, Ohio.	Proprietor and Superintendent of Hicksville Electric Light Plant.
Lovejoy, Ellis, 1885, E. E...... New Lexington, Ohio.	General Manager, Imperial Clay Co.
Lyon, Arthur H., 1900, M. E... Bucyrus, Ohio.	Works Manager, New York Blower Co.

M

Manley, Rush E., 1894, E. E... Columbus, Ohio.	Chief Inspector, Central Union Telephone Co.
Marckworth, O. S., 1901, B. Sc. (Chem.) Columbus, Ohio.	Manager, Ohio Testing Laboratory.
Marker, James R., 1904, C. E... Greenville, Ohio.	County Surveyor.
Marquardt, Frank F., 1896, C. E. Sharon, Pa.	Superintendent, The Sharon Coke Co.
Marquardt, William B., 1905, E. M. Sharon, Pa.	With The Sharon Steel Co.
Marshall, Chas. H., 1903, M. E. Fort Wayne, Ind.	With Western Gas Construction Co.
Marshall, W. B., 1900, E. E....	
Martin, George, 1897, E. E..... Elyria, Ohio.	Foreman Drafting, Electrical Dept., National Tube Co.
Martin, John D., 1901, M. E.... New Straitsville, Ohio.	Coal Operator.
Martin, Ray M., 1904, M. E.... Inglis, Fla.	Chief Engineer, Barker Chemical Co.
Martin, Percy, 1892, E. E...... Coventry, England.	General Manager, Daimler Motor Co.
Marvin, Charles F., 1883, M. E. Washington, D. C.	Professor of Meteorology, in Charge Instrument Division, U. S. Weather Bureau.
Masters, George A., 1886, C. E.. Topeka, Kansas.	Assistant Bridge Engineer, A. T. & S. F. Ry. System.
Matson, William E., 1896, E. E.	Died July 9, 1905.
McAllen, Wm. J., 1894, C. E... Chicago, Ill.	Civil Engineer, Structural Department, North Works, Illinois Steel Co.
McCarter, R. D., Jr., 1895, E. E. London, E. C., England.	Manager and Engineer, Bath Electric Tramway, Ltd.

McComb, Hoyt S., 1904, E. M. Los Esperanzas, Coah., Mex.	With Mexican Coal & Coke
McCormick, J. H., 1880, M. E. 1354 Fair Ave., Columbus, O.	Mechanical Engineer.
McCormick, W. F., 1896, M. E. Columbus, Ohio.	
McFarland, H. M., 1902, E. M. Birmingham, Ala.	Assistant Mining Engineer, Tenn. Coal & Iron Co.
McGarey, Leo S., 1904, E. E. Columbus, Ohio.	With Scioto Valley Traction Company.
McGrew, John A., 1895, C. E. Columbus, Ohio.	Consulting and Contracting Engineer.
McGuffey, F. H., 1894, E. E. Columbus, Ohio.	Clerk in Railway Mail Service.
McIntire, Alfred H., 1898, E. E.; 1900, M. E. Pittsburg, Pa.	Editor, The Electric Journal.
McIntosh, Roscoe E., 1902, E. E. Los Angeles, Cal.	Consulting Electric Engineer, with R. S. Masson.
McKeon, Robert D., 1902, C. E. Logansport, Ind.	Assistant on Engineers' Corps, Logansport Div., P., C., C. & St. L. Ry.
McMaster, Carlos L., 1905, C. E. Champaign, Ill.	Instructor in Drawing, Univ. of Illinois.
McNary, G. B., Jr., 1896, E. E. Toledo, Ohio.	Purchasing Agent, F. Bissell Company.
Meiklejohn, Robert, 1904, M. E. Chicago, Ill.	With Illinois Steel Co.
Melick, Cyrus A., 1903, C. E. Norfolk, Va.	Draftsman, Tidewater R. R.
Melick, Neal A., 1900, C. E. Norfolk, Va.	Engr. R. of W., Tidewater R. R.
Mellinger, A. H., 1905, E. E. Pittsburg, Pa.	With Westinghouse Elec. & Mfg. Co.
Menough, A. G., 1894, E. M. Wellsville, Ohio.	Secretary and Treasurer, Menough Iron & Steel Fdry. Co.
Mercer, Frank E., 1896, E. E. San Francisco, Cal.	With Risdon Iron and Locomotive Works.
Mercer, Robert W., 1903, E. M. Gary, McDowell Co., W. Va.	Computer, U. S. Coal & Coke Company.
Merrill, Ernest M., 1902, C. E. Beckley, W. Va.	General Engineering.
Merrill, Ferrand S., 1905, C. E. Toledo, Ohio.	With American Bridge Co.
Mershon, Ralph D., 1890, M. E. 11 Pine St., N. Y. City.	Consulting Engineer.
Metz, Ora F., 1905, E. E. Cincinnati, Ohio.	With Bullock Electric Co.
Miller, Albert A., 1902, C. E. Baltimore, Md.	Assistant Engineer to Chief Engineer, Maintenance of Way, B. & O. R. R.

Miller, Frank Case, 1893, C. E.. Sacramento, Cal.	Division Engineer, Sacramento Div., Southern Pacific Ry.
Miller, Henry F., 1889, M. E.. 345 E. State St., Columbus, O.	Consulting Engineer.
Miller, Ralph C., 1901, C. E.... Cambridge, Ohio.	Asst. Engr., Penna. Lines.
Minor, Wells H., 1903, E. M... Box 124, Central City, Ky.	Mining Engineer, Central Coal & Iron Co.
Minton, LeRoy H., 1904, E. M.. (Cer.) Mineral City, Ohio.	With C. Edwards Holden.
Mooney, George L., 1903, E. E... Pittsburg, Pa.	With Westinghouse Elec. & Mfg. Co.
Morlan, Wilbert, 1903, M. E... Milwaukee, Wis.	With Allis-Chalmers Co.
Morris, Clyde T., 1898, C. E.... Columbus, Ohio.	Associate Professor Civil Engineering, O. S. U.
Morris, Robert H., 1901, E. M.. Masontown, Pa.	Supt. Roberts & Schaefer Co.
Morris, Willard B., 1903, M. E.. Columbus, Ohio.	With C. E. Morris & Co., Structural Steel Works.
Morris, William B., 1902, M. E. Mt. Vernon, Ohio.	Draftsman, C. & G. Cooper Co.
Morrison, Robert O., 1893, C. E. Zanesville, Ohio.	Assistant Engineer, C. & M. V. R. R.
Morton, George L., 1884, M. E.. Washington, D. C.	Principal Examiner, Instruments of Precision, U. S. Patent Office.
Munn, Mortimer A., 1894, C. E.. Baltimore, Md.	Civil Engr., with the Roberts-Abbott Co.
Murphy, Joseph L., 1903, C. E.. Floodwood, Ohio.	Mining Engineer, N. Y. Coal Company.
Myers, Albert B., 1900, E. M... Tepezala, Aguascalientes, Mex.	Superintendente, Minas Tepezalanas.
Myers, Ord, 1895, E. E......... New York City.	Electrician, Metropolitan St. Railway Co.
Myers, Roy V., 1893, C. E...... Dayton, Tenn.	Superintendent Mines, Dayton Coal & Iron Co., Ltd.
Myers, Uriah H., 1887, E. M... Pittsburg, Pa.	Printer and Stationer, Meyers & Shinkle.

N

Nagel, William G., 1895, M. E.. Toledo, Ohio.	President and Manager, W. G. Nagel Electric Co.
Nauss, Ralph W., 1901, B. Sc.. (Chem.) Columbus, Ohio.	Student, Northwestern University Medical School.

Needham, Harry S., 1900, M. E. Dennison, Ohio.	Assistant General Foreman, P., C., C. & St. L. R. R. Shops.
Nelson, Fred B., 1905, C. E..... New York City.	Assistant Engineer, with John A. Cole & Sons.
Nesbit, Chas. E., 1904, B. Sc.... (Chem.) 321 Boren Ave., Seattle, Wash.	Chemist for Rubber Works.
Nesbitt, F. C., 1905, E. E....... 247 E. Broad, Columbus, O.	
Newton, Samuel D., 1895, C. E. Knoxville, Tenn.	Civil Engineer, Southern Ry. Company.
Nichols, Harry B., 1903, C. E.. Wheeling, W. Va.	Draftsman in U. S. Engineer's Office, Ohio River Improvement.
Nicholson, C. M., 1900, E. E.... Cincinnati, Ohio.	Foreman on Testing and Constructing Depts., Bullock Elec. Mfg. Co.
Nidy, Herbert C., 1901, E. E.... Cleveland, Ohio.	With Cleveland Electric Railway Co.
Nold, John H., 1900, E. M....... Columbus, Ohio.	Mine Engineer, Assistant to F. A. Ray.
Nold, Frederick B., 1905, E. M.. Arcade, New York.	With Hoover & Kinnear.
Nurian, Kerson, 1899, M. E.... St. Louis, Mo.	With Engineering Dept., Missouri Pacific Ry.
Nye, Ralph D., 1903, E. E...... Pittsburg, Pa.	In Power Dept., Westinghouse Elec. & Mfg. Co.

O

O'Brine, David, 1881, B. Sc., M. Sc.; 1882, E. M., D. Sc., M. D. Urbana, Ohio.	Physician and Surgeon.
Ogden, Ellsworth, 1905 .... Shawnee, Ohio.	With Ohio Mining & Mfg. Co.
Orndorf, Earl L., 1903, B. Sc. (Chem.) Cincinnati, Ohio.	Assistant Chemist, Proctor & Gamble Co.
Orton, Edward, Jr., 1884, E. M.. Columbus, Ohio.	Professor of Ceramics, Ohio State University, State Geologist of Ohio.

P

Pabodie, Robert J., 1899, M. E.. Watertown, N. Y.	Salesman Engineer, Watertown Engineering Co.
Palmer, Walter K., 1893, M. E. 718 Dwight Bldg., Kansas City, Mo.	Consulting Mechanical and Electrical Engineer.

Parrett, Benj. C., 1902, B. Sc. (Chem.) Struthers, Ohio.	Chemist, Struthers Furnace Company.
Patch, Homer A., 1896, C. E. Minneapolis, Minn.	Draftsman, Minneapolis Steel & Machinery Co.
Payne, Halbert E., 1887, M. E. New York City.	President, American Typewriter Co.
Pearl, Allen S., 1894, E. E. Chicago, Ill.	Manager, Specialty Dept., Central Elec. Co., Chicago, Ill.
Peirce, John M., 1895, E. E. Los Angeles, Cal.	With Home Telegraph & Telephone Co.
Pelton, Forrest B., 1904, E. E. Schenectady, N. Y.	In Testing Dept., General Electric Co.
Peppel, Samuel V., 1899, B. Sc. (Chem.) Columbus, Ohio.	Chemical Engineer.
Peters, William L., 1885, M. E. Riverside, Cal.	Horticulturist.
Peterson, John W., 1903, C. E. in Arch. Pittsburg, Pa.	Inspector, Chief Engineer's Office, P., C., C. & St. L. Ry.
Pflueger, Edwin B., 1905, C. E. Cleveland, Ohio.	With the Erie R. R. Company.
Pleukharp, C. V., 1885, M. E. La Crescenta, Cal.	Clergyman.
Polk, Walter C., 1895, C. E. Birmingham, Ala.	Telephone Engineering and Construction.
Postle, Herman R., 1894, C. E. South Pasadena, Cal.	Civil Engineer.
Poto, Frank B., 1901, B. Sc. (Chem.) Sta. C, Columbus, Ohio.	Chemist, Carnegie Steel Co.
Powell, Charles S., 1893, E. E. 111 Broadway, N. Y. City.	General Agent, Westinghouse Electric & Mfg. Co.
Powell, Ivan E., 1904, E. E. Rochester, N. Y.	Engineering Assistant, Rochester Ry. & Light Co.
Pratt, Fred Kellogg, 1900, C. E. Colorado Springs, Col.	Teacher of Mathematics, High School.

R

Rawson, Levi, 1899, C. E. Sistersville, W. Va.	Engineer, Carter Oil Company.
Ray, Frank A., 1887, E. M. 137 King Ave., Columbus, O.	Professor of Mine Engineering, Ohio State University.
Ray, William M., 1893, C. E. Cleveland, Ohio.	Assistant Engineer, B. & O. R. R. Co.
Raymond, Coles A., 1894, C. E. Toledo, Ohio.	Asst. Engineer, American Bridge Co.
Reed, G. Nathaniel, 1903, M. E. Youngstown, Ohio.	Draftsman, with The William Tod Co.

Reed, Robert B., 1896, E. E. Akron, Ohio.	Electrical Contractor and Engineer.
Reed, William A., 1897, E. M. Telluride, Col.	Assistant Superintendent, Liberty Bell Gold Mining Co.
Ribot, Antonio y C., 1904, E. E. Schenectady, N. Y.	With General Electric Co.
Rice, Herbert A., 1897, C. E. Lawrence, Kas.	Assistant Professor in Civil Engineering, Univ. of Kas.
Rice, Ray H., 1904, C. E. Columbus, Ohio.	
Riddle, John S., 1904, E. E. New York City.	With R. D. Mushan, 11 Pine Street.
Riddle, Howard S., 1897, E. E. Columbus, Ohio.	Engineer, Jeffrey Mfg. Co.
Rigdon, Carl, 1905, M. E. Columbus, Ohio.	Fellow in Experimental Eng., Ohio State University.
Rightmire, R. E., 1902, M. E. Columbus, Ohio.	Special Apprentice, Hocking Valley Railway Co.
Ritchie, George A., 1903, C. E. Columbus, Ohio.	Contracting Engineer.
Robinson, Erdis G., 1893, C. E. Columbus, Ohio.	Secretary and Treasurer, Robinson-Tilton Machinery Co.
Robinson, Richard W., 1905, C. E. Amridge, Pa.	With American Bridge Co.
Robinson, Louis G., 1905, M. E. Cincinnati, Ohio.	
Rogers, James B., 1896, E. M. Leetonia, Ohio.	Assistant Superintendent, Salem Iron Co.
Root, Willis J., 1885, E. M. Columbus, Ohio.	General Supt., Carnegie Steel Co., Columbus Works.
Rose, Claude C., 1905, M. E. Columbus, Ohio.	With Pneumatic Tool Company.
Ross, Calvin B., 1903, E. E. Springfield, Ohio.	Engineer and Draftsman, Hopper Mfg. Co.
Rowlee, Henry A., 1897, M. E. Philadelphia, Pa.	Inspector of Ordnance, U. S. A., Midvale Steel Works.
Royon, Eduoard D., 1904, M. E. Lynn, Mass.	In Testing Department, General Electric Co.
Ruhlen, Carl M., 1898, M. E. Port Townsend, Wash.	Superintendent of Construction, Quartermaster's Dept., U. S. Army.
Ryland, Paul D., 1901, C. E. Bluefield, W. Va.	Roadmaster, Norfolk & Western Railway.

S

Sayers, Delbert B., 1905, E. M. Gary, West Va.	With U. S. Coal & Coke Co.
Schaaf, Downs, 1905, E. M. Omaha, Neb.	Laboratory of N. P. R. R. Co.

Schaub, E. L. T., 1885, M. E.... Columbus, Ohio.	Draftsman, Jeffrey Mfg. Co.
Schaup, Charles E., 1897, E. M. Berrysburg, W. Va.	Chief Engineer, Southern Coal & Transportation Co.
Scheibell, Wm. O., 1888, E. M.. Columbus, Ohio.	Consulting and Contracting Engineer for Concrete Construction.
Schertz, William A., 1904, E. E. Cincinnati, Ohio.	With Bullock Elec. Mfg. Co.
Schlafly, Roydon K., 1903, C. E. Columbus, Ohio.	Assistant Professor of Civil Engineering, O. S. U.
Schreiber, George E., 1900, E. E. St. Louis, Mo.	Engineer and Contractor.
Schreiber, John M., 1899, E. E.. Cleveland, Ohio.	In Engineering Dept., Cleveland Electric Street Ry.
Schroll, Otto, 1886, C. E....... Toledo, Ohio.	Superintendent, Toledo Division, Penn. Lines.
Schubert, C. W., 1903, C. E..... Mt. Vernon, Ohio.	Draftsman, Mt. Vernon Bridge Works.
Schultz, August C., 1905, C. E. Sandusky, Ohio.	City Engineer.
Schwab, Frank W., 1902, B. Sc. (Chem.) Newcomerstown, Ohio.	Chemist, James B. Clow & Sons.
Sedgwick, Edgar C., 1895, E. E.. Columbus, Ohio.	Chief Engineer, The Case Mfg. Co.
Senter, Herbert P., 1902, C. E... Columbus, Ohio.	With R. R. Marble.
Serva, Adam A., 1893, E. E..... Fort Wayne, Ind.	Assistant Sales Manager and Assistant Sec., Ft. Wayne Electric Works.
Shapter, G. H., 1905, E. E...... Schenectady, N. Y.	With General Electric Co.
Sharp, Charles C., 1888, C. E... Gauley Bridge, W. Va.	Mine Superintendent and Consulting Mining Engineer.
Shaw, Lucian, 1904, C. E...... W. Lafayette, Ohio.	Manufacturer of Cement Blk.
Shepard, Harvey L., 1903, B. Sc. (Chem.) 901 Chateau Ave., Cincinnati, Ohio.	Chemist.
Shepherd, C. W., 1900, C. E..... Chicago, Ill.	In Structural Dept., North Works, Illinois Steel Co.
Sherman, Chris. E., 1894, C. E.. Columbus, Ohio.	Professor of Civil Engineering, Ohio State University.
Sherman, John K., 1901, C. E.. Cincinnati, Ohio.	Assistant on Engineers' Corps, Pennsylvania Lines, West of Pittsburg.
Sill, Edgar T., 1904, E. E....... Pittsburg, Pa.	In Testing Dept., Westinghouse Elec. & Mfg. Co.

Simonton, Mark, 1895, E. E. Columbus, Ohio.	Manager, Electric Supply & Construction Co.
Singleton, Fred, 1904, M. E. Columbus, Ohio.	With Hocking Valley R. R.
Skinner, C. E., 1890, M. E. Pittsburg, Pa.	Engineer, Electrical Engineering Dept., Westinghouse Elec. & Mfg. Co.
Sloctemyer, Carl F., 1903, E. E. Cincinnati, Ohio.	In Engineering Dept., Cincinnati Traction Co.
Small, James B., 1905, E. M. Columbus, Ohio.	Died April 2, 1906.
Smith, David W., 1899, C. E. Columbus, Ohio.	Engineer, Hocking Valley Ry. Co.
Smith, Harry Ford, 1902, M. E. Lexington, Ohio.	Manager, Elec. Light Plant.
Smith, Carl Joseph, 1905, E. M. Cleveland, Ohio.	With American Steel & Wire Co.
Smith, Roy B., 1904, M. E. Columbus, Ohio.	Apprentice, Motive Power Dept., Penn. Lines.
Snider, C. M., 1897, B. Sc. (Ind. Arts.) Columbus, Ohio.	Mechanical Engineer, The Jeffrey Mfg. Co.
Sosman, Robert B., 1903, B. Sc. (Chem.) Boston, Mass.	Assistant in Chemistry, Mass. Inst. of Tech.
Sperr, Frederick W., 1883, E. M. Houghton, Mich.	Professor of Civil and Mining Engineering, Michigan College of Mines.
Spitler, Grovey O., 1904, B. Sc. (Chem.) Findlay, Ohio.	
Sprague, C. M., 1899, C. E. Pittsburg, Pa.	Assistant on Engineers' Corps, P., C., C. & St. L. Ry., Pittsburg Division
Sproat, Amasa D., 1902, E. M. Fresnillo, Mexico.	Superintendent Fresnillo Mining Co
Spurrier, John R., 1896, E. E. Manchester, England.	Superintendent of Plant Dept., British Westinghouse Elec. & Mfg. Co.
Staley, Marcellus, 1899, E. E. New York City.	Firm of Staley & Gillespie, Electrical Contractors.
Stanton, Fred M., 1904, B. Sc. (Chem.) World's Fair Grounds, St. Louis, Mo.	With U. S. Fuel Testing Plant.
Starbuck, Daniel K., 1899, E. E. Schenectady, N. Y.	With General Electric Co.
Stellhorn, Adolf, 1900, A. B.; 1903, C. E. Columbus, Ohio.	Transitman, City Engineer's Office.

STEWART, ALTON R., 1904, E. E.. Rochester, N. Y.	Engineering Asst., Rochester Ry. & Light Co.
STEWART, HARFORD T., 1896, E. E. Columbus, Ohio.	Secretary, Case Mfg. Co.
STEWART, LEE R., 1896, C. E..... Camden, N. J.	Engineer in Charge of Mould Loft, New York Ship Building Co.
STEWART, WALTER S., 1905, E. M. Des Moines, Ia.	With Smith-Lowe Coal Co.
STINEBAUGH, ISAAC L., 1892, C. E. Rockaway, Ohio.	Surveyor and Civil Engineer.
STOCKER, JAMES A., 1902, C. E.... Charleston, W. Va.	Assistant Engineer, Kanawha & Michigan Railway.
STONE, CARLTON E., 1899, C. E.. Pittsburg, Pa.	With the P. & L. E. Ry.
STONE, THOMAS W., 1902, M. E.. Fort Wayne, Ind.	Asst. Engineer, Western Gas Construction Co.
STORER, NORMAN W., 1891, E. E.. Pittsburg, Pa.	Elec. Eng'r., Ry. Dept., Westinghouse Elec. & Mfg. Co.
STORER, SIMON B., 1893, E. E.... Syracuse, N. Y.	Eng'r. and Salesman, Westinghouse Elec. & Mfg. Co.
STULL, EMMETT W., 1894, E. E.. Cincinnati, Ohio.	Engineer, Railway Dept., Bullock Elec. Mfg. Co.
STULL, RAYMOND T., 1902, E. M.. (Ceramics.) Terra Cotta, Ill.	Chemist, American Terra Cotta & Ceramic Co.

T

TANNER, EDWARD W., 1902, M. E. Bedford, Ohio.	Draftsman, The Interstate Engineering Co.
TAYLOR, ARTHUR W., 1893, E. M. Cleveland, Ohio.	Chemist, Otis Steel Co., Ltd.
TAYLOR, WILLIAM O., 1904, E. E. Columbus, Ohio.	Asst. Electrician, Col., London & Springfield Ry.
TEMPLIN, JOHN R., 1903, M. E.. Christ Church, New Zealand.	With General Electric Co.
TENNEY, EDWARD H., 1905, M. E. St. Louis, Mo.	With Union Electric Light & Power Co.
THOMAS, EDWARD, 1904, B. Sc. (Chem.) Copley, Pa.	Cement Inspector.
THOMAS, JAMES O., 1897, C. E.. Columbus, Ohio.	District Toll Chief, Central U. Telephone Co.
TOWNE, ROBERT S., 1879, B. Sc.; 1880, E. M. New York City.	President, Campania Metallurgica Mexicana.
TUFTS, CHARLES H., 1899, E. E.. Pittsburg, Pa.	Chief Chemist, Shoenberger Wks., Am. Steel & Wire Co.
TURNER, ARTHUR M., 1893, E. E.. 726 Farrell Ave., Chicago, Ill.	With Barnhart Bros. & Spindler.

U

URBAN, HARRY M., 1898, C. E... Wheeling, W. Va.	Department Engineer, National Tube Co., Riverside Dept.

V

VAN DYKE, C. S., 1902, E. E..... Schenectady, N. Y.	In Testing Dept., General Electric Co.
VAN TINE, C. H., 1903, M. E.... Muncie, Ind.	Draftsman, Indiana Bridge Co.
VANDERVOORT, W. P., 1886, E. M..	
VENNUM, GEO. C., 1905, M. E.... St. Louis, Mo.	With Union Electric Light & Power Co.
VIETS, WILLIS B., 1886, E. M... Parryville, Carbon Co., Pa.	Chemist, Carbon, Iron & Steel Co., Ltd.
VOSSKUEHLER, J. H., 1900, M. E. Madison, Wis.	Instructor in University of Wisconsin.

W

WADSWORTH, F. L. O., 1888, E. M.; 1889, B. Sc., M. E. Pittsburg, Pa.	Chief Engineer, American Window Glass Co.
WALKER, DOWNIE R., 1905, M. E. Beloit, Wis.	With Fairbanks-Morse Co.
WALKER, JAMES M., 1896, C. E... Knoxville, Tenn.	Resident Engineer, K. La., F. & J. R. R.
WARD, KENNETH B., 1905, C. E.. Columbus, Ohio.	Assistant in Civil Engineering, Ohio State University.
WARD, SAMUEL E., 1904, M. E... Pittsburg, Pa.	With Westinghouse Machine Co.
WARD, VERNON C., 1903, M. E... Chicago, Ill.	Estimator, North Works, Illinois Steel Co.
WATT, SERN P., 1886, M. E...... Seattle, Wash.	Mechanical Designer, Moran Bros. Co.
WATTERS, BURR S., 1904, M. E... Columbus, Ohio.	Draftsman, Columbus Railway & Light Co.
WAY, KARL M., 1905, E. M...... St. Louis, Mo.	With U. S. Fuel Testing Plant.
WEAVER, GEORGE H., 1905, M. E.. Cleveland, Ohio.	With Bruce, Merriam-Abbott Co.
WEBBER, FRANK M., 1903, E. E... Fort Wayne, Ind.	In Sales Dept., Ft. Wayne Electric Works.
WEBER, F. CLARENCE, 1901, B. Sc. (Chem.) Washington, D. C.	With Bureau of Chemistry, U. S. Agricultural Dept.
WEICK, C. W., 1898, B. Sc. (Ind. Arts.) New York City.	Instructor in Manual Training, Teachers' College, Columbia University.

Weinland, Herman G., 1905, M. E. Springfield, Ohio.	With Lagonda Mfg. Co.
Welch, Clark J., 1888, C. E.... 11 Broadway, N. Y. City.	Bridge and Structural Engineer.
Welch, Oliver B., 1895, E. E.... P. O. Box 1618, Pittsburg, Pa.	Mechanical Engineer.
Wellbaum, Arvy E., 1902, M. E. Springfield, Ohio.	Draftsman, Foos Mfg. Co.
Wilcox, Alva N., 1895, E. E.... Dayton, Ohio.	The Pinneo & Daniels Co.
Wilcox, Carl C., 1903, M. E.... Birmingham, Ala.	Mechanical Engineer, Tenn. C. I. & R. Co.
Williams, Ernest D., 1905, M. E. Schenectady, N. Y.	With General Electric Co.
Williams, Harry E., 1902, M. E. Omaha, Neb.	Special Apprentice, Union Pacific R. R. Shops.
Williams, S. B., 1905, E. E..... Chicago, Ill.	With Western Electric Co.
Williamson, H. D., 1901, B. Sc. (Chem.); M. D. Starling Med. Col., 1904. Columbus, Ohio.	Physician
Wise, Albert Joseph, 1898, C. E. Wilson Blk., Houston, Tex.	Civil Engineer.
Wolf, Herman H., 1895, C. E... Washington, D. C.	Lieutenant, U. S. Revenue Cutter Service.
Wolfe, Arthur C., 1905, M. E.. Mt. Vernon, Ohio.	With C. & G. Cooper Co.
Wyer, Samuel S., 1903, M. E... Forsythe Ave., Columbus, O.	Consulting Engineer, Gas Specialist.
Wylie, Arthur R., 1905, M. E... Lexington, Ohio.	With Smith Gas Power Co.
Wynne, Francis E., 1902, E. E.. Pittsburg, Pa.	With Westinghouse Electric & Manufacturing Co.

Y

Yost, Lloyd, 1902, M. E......... Cudahy, Wis.	With The Power & Mining Co.
Youmans, Wm. R., 1903, E. E... Schenectady, N. Y.	In Testing Dept., General Electric Co.

Z

Zaumseil, Oscar C., 1887, C. E.. Webb City, Mo.	Merchant.
Zurfluh, Wm. N., 1894, E. E... Springfield, Ohio.	Superintendent, Home Lighting, Power & Heating Co.

List of Graduates from Other Colleges of the Ohio State University Who Are Now Doing Engineering Work

Blinn, Ray S., 1893, B. Sc. Bloomington, Ind.	Asst. Engineer, Ilinois Central R. R.
Bradford, Ernest, 1892, G. Ph. Columbus, Ohio.	Superintendent and Metallurgist, Pioneer Stove Co.
Calkins, Wm. B., 1898, G. Ph. St. Louis, Mo.	Chief Chemist, LaClede Gas Light Co.
Converse, H. P., 1887, B. Sc. Boston, Mass.	Of H. P. Converse & Co., Engineers and Contractors in Iron and Steel.
Evans, Ernest, 1892, B. Sc. Donora, Pa.	Superintendent, Blast Furnaces, Carnegie Steel Co.
Heath, Arthur T., 1887, G. Ph. Oak Harbor, Ohio.	Analytical Chemist, Consulting Eng. and Contractor.
Humphrey, J. S., 1879, B. Sc. Indianapolis, Ind.	Assistant City Civil Engineer.
Jones, Jesse Lee, 1890, B. A. Wilmerding, Pa.	Metallurgist, Westinghouse E. & M. Co.
Kirker, Harry L., 1889, B. Sc. London, England.	Electrical Engineer, Westinghouse Elec. & Mfg. Co.
Knopf, George W., 1883, B. Sc. Pottstown, Pa.	Engineer, McClintic-Marshall Construction Co.
Lewis, Thomas K., 1894, B. Sc. Columbus, Ohio.	Assistant Professor of Architecture and Drawing, Ohio State University.
Lovejoy, Jesse R., 1884, B. Sc. Schenectady, N. Y.	Manager, Lighting, Railway & Supply Dept., General Electric Co.
McDowell, John A., 1882, B. Sc. Columbus, Ohio.	Chemist, Specialty Portland Cement Manufacture, Mine Examiner.
Mix, Edgar W., 1888, B. Sc. 12 Boul. des Invalides, Paris, France.	Electrical Engineer.
Moyer, Henry E., 1893, B. Sc. Youngstown, Ohio.	Chief Chemist, Youngstown Steel Co.
Newton, Harry S., 1889, B. Sc. Warehouse Point, Conn.	General Supt., Hartman & Springfield St. Ry. Co.
Phelps, Cyrus A., 1892, B. Sc. Chalchihuites, Mexico.	Treasurer, Cia Minera "Huiriachie," S. A.
Ritchey, Joseph C., 1890, B. Sc. Cleveland, Ohio.	Chemist, American Works, A. S. & W. Co.
Scott, Charles F., 1885, B. A. Pittsburg, Pa.	Electrical Engineer, Westinghouse Electric & Mfg. Co.
Sommermeier, E. E., 1898, G. Ph. Columbus, Ohio.	Assistant Professor in Metallurgy, Ohio State University.
Ward, John C., 1880, B. A. Painesville, Ohio.	County Engineer and Surveyor.

Wikoff, John B., 1884, B. Ph. Cleveland, Ohio.	Secretary and Treasurer, Imperial Clay Co., New Lexington, Ohio.

Directory of Those Who Have Completed Short Courses

ARCHITECTURE

Elliott, Emmett F., 1901 Columbus, Ohio.	Draftsman, Richards, McCarty & Bulford, Architects.
Gleichauf, Frank S., 1901 Columbus, Ohio.	Supervising Architect, Richards, McCarty & Bulford, Architects.
Howard, Oscar D., 1902 Columbus, Ohio.	Draftsman, with W. T. Mills, Architect.
Miller, Charles E., 1900 Akron, Ohio.	Master Mechanic, Diamond Rubber Co.

CERAMICS

Adams, John Carroll, 1897 Lynchburg, Va.	Manager of Brickyard
Berkey, Leslie Reese, 1899 Eldorado, Pa.	Manager, Eldorado Brick Co.
Bleininger, Albert V., 1897; 1901, B. Sc. (Chem.) Columbus, Ohio.	Assistant Professor in Ceramics, Ohio State University.
Braddock, Everett F., 1896	
Campbell, Augustine R., 1898 Tottenville, S. I., New York.	Chemist, Atlanta Terra Cotta Co.
Colgan, Frank J., 1901 Grassy Point, N. Y.	With A. M. & W. H. Wiles Co.
Gates, Ellis D., 1901 Chicago, Ill.	Treasurer American Terra Cotta & Ceramic Co.
Giessen, Carl, 1896 Canton, Ohio.	
Gorton, Elmer Ellsworth, 1896. Croton-on-Hudson, N. Y.	General Manager, W. A. Underhill Brick Co.
Greaves-Walker, A. F., 1904 Olive Hill, Ky.	With the Olive Hill Fire Brick Co.
Griffin, Carl H., 1902 Worcester, Mass.	Chemist, Norton Emery-Wheel Co.
Hensel, Otto, 1897 New Lexington, Ohio.	With Imperial Clay Co.
Ittner, Warren Wayne, 1899 Bellville, Ill.	Superintendent, Ittner Brick Co.
Jones, Edward J., 1896 Covington, Ky.	Ceramic Chemist, Cambridge Tile Mfg. Co.
Klaus, Frederick J., 1904 Los Angeles, Cal.	With Southern Pacific Railway Co.

McMillen, Harry, 1904 Nampa, Idaho.	Foreman, Stoneware Pottery.
Morrison, Frank H., 1901 Denver, Colo.	Manager, Colorado Porcelain Co.
Porter, Walter J., 1904 Stockton, Cal.	With Stockton Brick & Pottery Co.
Post, Malcolm Phelps, 1899 Texarkana, Tex.	Superintendent Post Pipe Co.
Purdy, Ross C., 1898 Champaign, Ill.	Instructor Ceramics, University of Illinois.
Ogan, Mark, 1904 St. Louis, Mo.	With St. Louis Terra Cotta Co.
Reynolds, Edwin W., 1905 Schenectady. N. Y.	With the Porcelain Dept., Gen- Electric Co.
Sandison, Jack Morrison, 1892 Moberly, Mo.	Superintendent, Moberly Brick, T & E. Co.
Singer, Louis Parmelee, 1902 Lincoln, Cal.	Ceramic Chemist, with Gladding, McBean & Co.
Thomas, David C., 1896 Wellsville, Ohio.	Head Burner, U. S. Pottery Co.
Watts, Arthur S., 1901 New Lexington, Ohio.	Superintendent, High Voltage Porcelain Co.
Wells, Harry B., 1904 Canandaigua, N. Y.	With Hydraulic Press Brick Co.
Wolfley, John W., 1896 Mt. Gilead, Ohio.	Superintendent, Johnson-Wolfley Pottery Co.
Worcester, Wolsey G., 1899 Columbus, Ohio.	Ceramist.

INDUSTRIAL ARTS

Benbow, James D., 1901 Columbus, Ohio.	Chief Draftsman, Kilbourne-Jacobs Mfg. Co.
Hoover, Frank G., 1903 New Berlin, Ohio.	With The W. H. Hoover Co.
Lynn, Harry, 1903 Columbus, Ohio.	With W. M. Ritter Lumber Co.
Pidgeon, Clifford H., 1905 Columbus, Ohio.	Special Student, Ohio State University.
Sellers, Russell M., 1905 Drummond, Pa.	With Shawmut Clay Manufacturing Co.
Smith, Frank E., 1905 Bellevue, O.	With The Gross Lumber Co.
Tansey, Howard F., 1903 Franklin, Warren Co., Ohio.	Farmer.
Umberger, Kyle D., 1903 Clarksburg, W. Va.	Draftsman and Estimator, Richards Construction Co.

MINING

Anderson, Arthur, 1898.
Athens, Ohio.

Bohm, Oscar Herman, 1899.
Cleveland, Ohio.

Blower, J. W., 1892.
Mine Manager, Trimble, O.

Boyd, Arthur, 1893.
Mine Surv., Saginaw, Mich.

Brophy, John S., 1898.
Frostburg, Md.

Carroll, P. H., 1891; 1894, E. M.
Herrin, Illinois.

Dixon, C. F., 1890.

Evans, John M., 1895.

Evans, William, 1902.
Engineer, Superior Coal Co., Wellston, Ohio.

Fitzer, Joseph B., 1903.

Fyfe, John, 1891.

Gildroy, R. E., 1891.

Harrigan, Archer, 1899.
Min. Eng., K. & H. C. & C. Co., Harewood, W. Va.

Harrigan, Patrick, 1898.
Supt., Congo Coal & Mining Co., Congo, Ohio.

Herron, J. S., 1893.

Jenkins, Jonathan, 1891.
Mine Foreman, Lord, Md.

King, Francis E., 1900.
Asst. Mgr., Dominion Coal Co., Glace Bay, C. B., Can.

Laviers, Henry, 1893.
Engineer, Superior Coal Co., Wellston, Ohio.

Lawson, John F., 1904.
Assistant Engineer, Pittsburg Coal Co., Nelsonville, O.

Lochrie, John, 1890.
Gen. Mine Supt., Windber, Pa

McKay, R. F., 1894.
Supt. and Engineer Freeport Smokeless Coal Co.

Moss, James, 1891.
Supt. and Mining Engineer, Cambridge, Ohio.

Newton, E. A., 1893.
Dealer in Knitting Machinery, 245 Case St., Philadelphia, Pa.

Nichols, J. L. D., 1895.

Oakes, C. H., Jr., 1892.
Manager, Volant, Pa., R. F. D. No. 65.

Ogan, Mark, 1904.
With St. Louis Terra Cotta Co., St. Louis, Mo.

Phillips, F. R., 1893.

Quigley, John, 1893.
Mine Foreman, Snow Shoe, Pa.

Quigley, Robert, 1894.
Mine Foreman, Burnside, Pa.

Quinn, John, 1891.
Civil and Mining Engineer, Houtzdale, Pa.

Ralston, William, 1896.
Cleveland, Ohio.

Rees, David, 1891.
Asst. Manager, Empire State, Idaho M. & D. Co., Wardner, Idaho.

Rees, Evan, 1895.
Mining Engineer, The Tom Corwin Coal Co., Wellston, Ohio.

Schettler, Bruno, 1905.
Min. Eng., Illinois Collieries Co., Springfield.

Siddall, J. W., 1901.
Mine Eng., Oliver Iron & Mining Co., Mt. Zion, Minn.

Snedden, James, 1892.

Stewart, Robert B., 1903

Tetlow, W. A.. 1892.
Salem, Ohio.

Thompson, Thomas, 1902.
Mine Supt., Bay City, Mich.

Wright, John, 1892.
Mine Foreman, Pottersdale, Pa.

Young, Thomas B., 1903.
Chemist with N. W. Lord, Columbus, Ohio.

The Ohio State University Bulletin is published fifteen times during the Academic year, as follows: Monthly in October, November, and June, and bi-weekly in December, January, February, March, April, and May. Entered as second-class matter November 17, 1905, at the Post Office at Columbus, Ohio, under Act of Congress, July 16, 1894.

VOLUME XI NUMBER 11

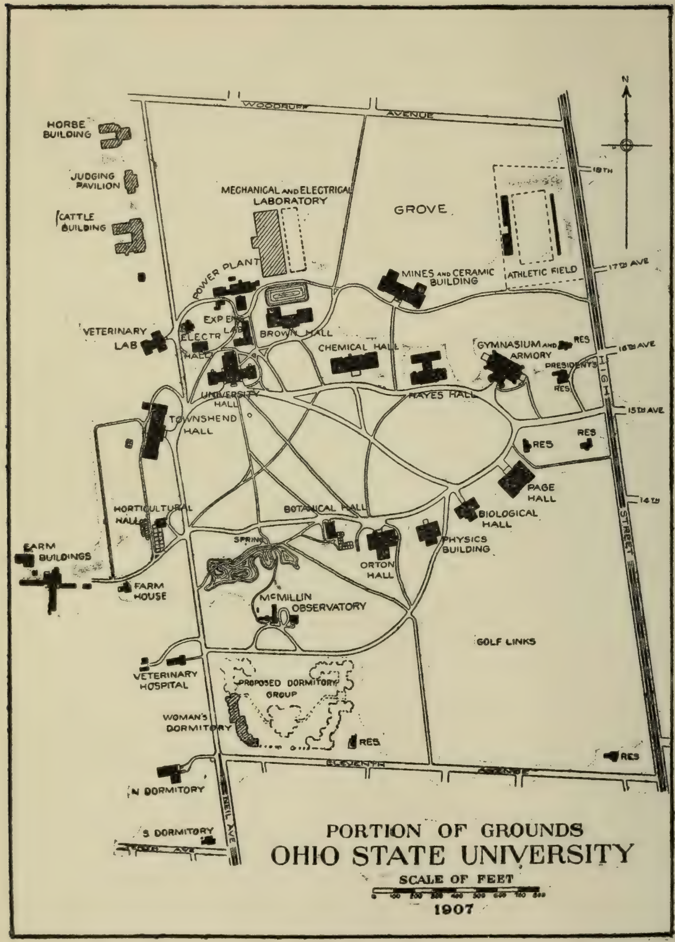
Ohio State University Bulletin

College of Engineering

APRIL 11, 1907

PUBLISHED BY THE UNIVERSITY AT COLUMBUS

Entered as second-class matter November 17, 1905, at the postoffice at Columbus, Ohio, under Act of Congress, July 16, 1894.



PORTION OF GROUNDS
OHIO STATE UNIVERSITY
SCALE OF FEET
1907

OHIO STATE UNIVERSITY

The Ohio State University, located in Columbus two miles north of the Union Station, is a part of the public educational facilities maintained by the State. It comprises six colleges:

The College of Agriculture and Domestic Science,
The College of Arts, Philosophy, and Science,
The College of Engineering,
The College of Law,
The College of Pharmacy,
The College of Veterinary Medicine.

This bulletin of announcements is devoted exclusively to the work of the College of Engineering.

(NOTE: In requesting any of the announcement bulletins of the University, address the Secretary of the University Faculty, Ohio State University, Columbus, Ohio.)

UNIVERSITY CALENDAR

1907

Entrance examinations, (8 a. m.) Tuesday to Saturday, June 11 to 15.

Summer courses in Surveying, June 14 to July 13.

Summer courses in Shop-Work, June 17 to July 13.

Summer term, June 24 to August 2.

Entrance examinations, (8 a. m.) Tuesday to Saturday, September 10 to 14.

First term begins—Registration Day—Tuesday, September 17.

President's Annual Address, (11 a. m.) Friday, September 20.

Latest date of admission to candidacy for a degree at the Commencement of June, 1908, Tuesday, October 1.

Thanksgiving recess, November 28 and 29.

Latest date for filing theses subjects, Saturday, December 14.

First term ends, Wednesday, December 18.

CHRISTMAS VACATION

1908

Second term begins—Registration Day—Thursday, January 2.

Washington's Birthday, Saturday, February 22.

Second term ends, Friday, April 3.

SPRING RECESS

Third term begins—Registration Day—Wednesday, April 8.

Field Day—Athletic Association—Saturday, May 9.

Competitive Drill—Cadet Regiment—Saturday, May 23.

Memorial Day, Saturday, May 30.

Final examinations, Friday to Thursday, June 12 to 18.

Latest date for presenting theses, Saturday, June 13.

Entrance examinations, (8 a. m.) Tuesday to Saturday, June 16 to 20.

Latest date for filing bound copy of thesis, Friday, June 19.

Commencement, Wednesday, June 24.

COLLEGE OF ENGINEERING

PURPOSE AND AIMS

The purpose of the College of Engineering is to thoroughly ground students in the fundamental sciences and arts upon which all engineering rests; to impart such special and technical knowledge of the various branches of engineering as is practicable in the time available; and finally, by the severe scholastic discipline of this training, together with collateral work in language and literature, to impart an appreciation of the pleasures of culture and scholarship, and a recognition of the civic duties and moral responsibilities which in modern society fall upon every educated man.

In the attainment of these inseparable ends, the work of the College of Engineering is directed, first, to the mastery of the principles of mathematics, physics, and chemistry by means of theoretical courses; second, by laboratory work in these and related sciences and in the graphic arts, to fix principles firmly in the mind of the student and develop his power to apply them to concrete cases; third, to give such opportunity for specialization in the various fields and departments of engineering as its constantly increasing scope and subdivision renders possible. Added to these technical subjects, instruction is given in the use of English, developing the power to write clear and concise reports, and in at least one foreign language sufficient to bring the technical literature of that language within grasp.

It is recognized that the graduate of any engineering school can have at best but a meagre equipment in the actual knowledge of engineering, and that he must inevitably be largely lacking in the experience and mature judgment which the competent engineer brings to his work. But he can at least gain at school a good foundation for accurate reasoning and sound judgment, and it is believed that these qualities are developed in higher degree by such carefully prescribed courses as are here offered, than in partially or wholly elective courses.

The great expansion in technical education witnessed in the last two decades has been due to two causes, first, the rapid growth of the manufacturing industries and of the great public works by which their products are distributed, and second, by the constantly increasing conviction in the minds of manufacturers and administrators that the capable, self-reliant and truthworthy men whom they need are produced in fuller degree by the rigid training of an engineering school than by any other means.

COURSES OFFERED

This college offers instruction in nine important fields of engineering work. Covering these the following four-year courses of study are offered:

1. Architecture, leadng to the degree of Civil Engineer in Architecture (C. E. in Arch.).

2. Ceramics, leading to the degree of Engineer of Mines in Ceramics (E. M. in Cer.).

3. Chemical Engineering, leading to the degree of Bachelor of Science in Chemical Engineering (B. Sc.).

4. Civil Engineering, leading to the degree of Civil Engineer (C. E.).

5. Electrical Engineering, leading to the degree of Mechanical Engineer in Electrical Engineering (M. E. in E. E.).

6. Industrial Arts, leading to the degree of Bachelor of Science in Industrial Arts (B. Sc.).

7. Manual Training, leading to the degree of Bachelor of Science in Industrial Arts (B. Sc.).

8. Mechanical Engineering, leading to the degree of Mechanical Engineer (M. E.).

9. Mine Engineering, leading to the degree of Engineer of Mines (E. M.).

The following two-year, or short courses, do not lead to a degree, but students completing them are furnished a formal certificate stating the work they have accomplished:

10. Clay-working.
11. Industrial Arts and Shopwork.
12. Mining.

The necessary instruction for these courses of study is given in twenty-three different departments under eighty-eight professors and assistants. In some of these courses there is opportunity for elective work, which may be selected from any of the forty departments of the University. The library of about 70,000 volumes includes the most important treatises in the different fields of engineering.

FACULTY AND INSTRUCTORS

WILLIAM OXLEY THOMPSON, D. D., LL. D., PRESIDENT OF THE UNIVERSITY.

FRANK ARNOLD RAY, E. M., DEAN and Professor of Mine Engineering.

FRANK EDWIN SANBORN, S. B., SECRETARY, Professor and Director of the Department of Industrial Arts.

NATHANIEL WRIGHT LORD, E. M., Professor of Metallurgy and Mineralogy and Director of the School of Mines.

EDWARD ORTON, JR., E. M., Professor and Director of the Department of Clay-working and Ceramics.

BENJAMIN FRANKLIN THOMAS, Ph. D., Professor of Physics.

ROSSER DANIEL BOHANNAN, B. Sc., C. E., E. M., Professor of Mathematics.

BENJAMIN LESTER BOWEN, Ph. D., Professor of Romance Languages and Literatures.

JOSEPH VILLIERS DENNEY, B. A., Professor of English.

WILLIAM THOMAS MAGRUDER, M. E., Professor of Mechanical Engineering.

WILLIAM MCPHERSON, JR., D. Sc., Ph. D., Professor of Chemistry.

JOSEPH NELSON BRADFORD, M. E., Professor of Architecture and Drawing.

HENRY CURWEN LORD, B. Sc., F. R. A. S., Professor of Astronomy and Director of the Emerson McMillin Observatory.

EMBURY ASBURY HITCHCOCK, M. E., Professor of Experimental Engineering.

FRANCIS CARY CALDWELL, B. A., M. E., Professor of Electrical Engineering.

*CHARLES SMITH PROSSER, M. S., Professor of Geology.

CHRISTOPHER ELIAS SHERMAN, C. E., Professor of Civil Engineering.

LEWIS ADDISON RHOADES, Ph. D., Professor of Germanic Languages and Literatures.

FRANK HARVEY ENO, B. Sc., C. E., Professor of Municipal Engineering.

JAMES ELLSWORTH BOYD, M. S., Professor of Mechanics.

THOMAS EWING FRENCH, M. E., Professor of Engineering Drawing.

GEORGE WASHINGTON MCCOARD, M. A., Associate Professor of Mathematics.

WILLIAM EDWARDS HENDERSON, Ph. D., Associate Professor of Chemistry.

CHARLES A. BRUCE, B. A., Associate Professor of the Romance Languages and Literatures.

CHARLES WILLIAM FOULK, B. A., Associate Professor of Chemistry.

G. A. ANDEREGG, A. M., Associate Professor ot Electrical Engineering.

MATTHEW BROWN HAMMOND, Ph. D., Associate Professor of Economics and Sociology.

CLYDE T. MORRIS, C. E., Associate Professor of Civil Engineering.

KARL DALE SWARTZEL, B. Sc., Associate Professor of Mathematics.

ALBERT VICTOR BLEININGER, B. Sc., Associate Professor of Clay-Working and Ceramics.

EDWARD ELSWORTH SOMERMEIER, G. Ph., Associate Professor of Metallurgy and Mineralogy.

WILLIAM ABNER KNIGHT, M. E., Assistant Professor of Machine-Shop Practise.

HARRY WALDO KUHN, Ph. D., Assistant Professor of Mathematics.

FREDERICK EDWARD KESTER, Ph. D., Assistant Professor of Physics.

HORACE JUDD, M. E., M. Sc., Assistant Professor of Experimental Engineering.

EDWIN F. CODDINGTON, Ph. D., Assistant Professor of Mechanics.

ROBERT F. EARHART, Ph. D., Assistant Professor of Physics.

ALLAN COGGESHALL, E. E., Assistant Professor of Electrical Engineering.

WILLIAM LLOYD EVANS, Ph. D., Assistant Professor of Chemistry.

CARSON SAMUEL DUNCAN, M. S., Assistant Professor of English.

GEORGE D. HUBBARD, Ph. D., Assistant Professor of Geology.

ROY K. SCHLAFLY, C. E., Assistant Professor of Civil Engineering.

CHARLES C. MAJOR, M. E., Assistant Professor of Engineering Drawing.

BERTHOLD AUGUST EISENLOHR, M. A., Assistant Professor of the Germanic Languages and Literatures.

SAMUEL EUGENE RASOR, B. Sc., Assistant Professor of Mathematics.

OLIVE JONES, B. A., Librarian.

GEORGE L. CONVERSE, Captain U. S. A. (Retired), Professor of Military Science and Tactics.

H. SHINDLE WINGERT, M. D., Director of Physical Education for Men.

SIDNEY AUGUSTUS NORTON, Ph. D., LL. D., Emeritus Professor and Lecturer in Chemistry.

STILLMAN W. ROBINSON, C. E., D. Sc., Emeritus Professor of Mechanical Engineering.

ROBERT WHITE MCFARLAND, LL. D., Emeritus Professor of Civil Engineering.

JOHN ADAMS BOWNOCKER, D. Sc., Professor of Inorganic Geology and Curator of the Museum.

DAVID R. MAJOR, Professor of Education.

JAMES EDWARD HAGERTY, Ph. D., Professor of Economics and Sociology.

GEORGE B. VILES, Ph. D., Associate Professor of Germanic Languages and Literatures.

WILLIAM LUCIUS GRAVES, M. A., Assistant Professor of English.

CHARLES LINCOLN ARNOLD, M. Sc., Assistant Professor of Mathematics.

EDGAR S. INGRAHAM, Ph. D., Assistant Professor of Romance Languages.

*THOMAS KENYON LEWIS, B. Sc., Assistant Professor of Engineering Drawing.

FAYETTE A. MCKENZIE, Ph. D., Assistant Professor of Economics and Sociology.

ROY STEVENSON KING, M. E., Assistant Professor of Mechanical Engineering.

JAMES WITHROW, Ph. D., Assistant Professor of Chemistry.

WILLIAM HENRY RENCK, Instructor in Pattern-Making and Founding.

CHARLES PHILIP CROWE, Instructor in Forging.

JOHN SATTERLEE TIDBALL, B. S., Instructor in Engineering Drawing.

---

*Absent on leave 1906-07.

RALPH ROGERS, Instructor in Engineering Drawing.

MAY THOMAS, Ph. D., Instructor in German.

MARY E. HASKELL, M. A., Instructor in Romance Languages.

ROBERT MEIKLEJOHN, M. E., Instructor in Engineering Drawing.

F. C. MCKINNEY, M. A., Instructor in English.

FRANK KELTON BAILEY, Ph. D., Instructor in Physics.

FRANK WILSON MOODY, Ph. B., Instructor in Physics.

W. J. NORRIS, Instructor in Engineering Drawing.

CLARENCE CHARLES VOGT, A. B., Instructor in Chemistry.

J. WARREN SMITH, M. Sc., Lecturer on Meteorology.

FRANK C. RIDDLE, Assistant in Clay-Working and Ceramics.

JOHN ROSS CHAMBERLIN, Assistant in Civil Engineering.

KENNETH BAKER WARD, C. E., Assistant in Civil Engineering.

ALBERT A. STRAUB, M. E., Assistant in Mechanical Engineering.

JOHN MCBRIDE KNOTE, M. A., Assistant in Chemistry.

C. A. PARK, Assistant in Astronomy.

FELLOWS

J. I. KINDLE, B. A., Mechanics.

CARL C. WILCOX, M. E., Mechanical Engineering.

WILLIAM V. LINDER, B. A., Chemistry.

CHARLES F. LONG, B. A., Chemistry.

BENJAMIN T. BROOKS, B. A., Chemistry.

ARLIE W. SCHORGER, B. A., Chemistry.

WARREN A. RUTH, B. A., Chemistry.

ADMISSION

Applicants for admission must be at least 17 years of age.

UNIVERSITY ENTRANCE BOARD

The admission of students is in charge of the University Entrance Board, which determines the credits which shall be issued on all entrance examinations and certificates, and furnishes all desired information to applicants. Correspondence relating to admission should be addressed to the Entrance Board, Ohio State University, Columbus.

ADMISSION TO THE COURSES LEADING TO DEGREES

There are two modes of admission to the courses leading to degrees: (a) by examination, (b) by certificate.

ADMISSION BY EXAMINATION

The Entrance Board will conduct entrance examinations June 11 to 15 and September 10 to 14, 1907. A part of the examinations may be taken in June and the remainder in September. All applicants for admission who are not graduates of an accredited or recognized secondary school or approved preparatory school, or who do not possess certificates from the State Board of School Examiners, must take examinations for admission.

SCHEDULE.—Examinations will be from 8 to 12 a. m. and from 1 to 5 p. m.

TUESDAY

A. M.—Greek and Roman History, English History, General History.

P. M.—Composition, Rhetoric and Classics, Chemistry, Geology.

WEDNESDAY

A. M.—Algebra, German, English Grammar, Descriptive Geography.

P. M.—Plane Geometry, Physical Geography, Arithmetic.

THURSDAY

A. M.—Civics, Solid Geometry, Zoology.
P. M.—Beginning Latin, Cæsar, Astronomy.

FRIDAY

A. M.—Physics, Physiology, Botany.
P. M. U. S. History, French, English Literature.

SATURDAY

A. M.—Virgil, Cicero.

ADMISSION BY CERTIFICATE

Applicants may be admitted without examination on presentation of properly indorsed certificates from such secondary schools as have been accredited* or recognized by the University, or from approved normal schools, or from the State Board of School Examiners under the following provisions:

(a) If from secondary schools, the certificate must show that the applicant is a graduate in good standing of the school issuing it; and also must state in detail the studies pursued, the text-books used, the amount of work done in each study, the amount of time devoted to it, and the fact that the applicant has passed in the work.

(b) Any entrance requirement not covered by a certificate must be met by examination.

Blank certificates may be obtained by addressing the Secretary of the Entrance Board. Certificates should be filled out and returned to the University as early as possible after the close of schools in June and in any event not later than September 7.

---

*Regarding accredited and recognized schools see page 23 and following.

REQUIREMENTS BY UNITS

Applicants to be admitted to full standing must obtain credit by examination or certificate for fifteen units, chosen from the five groups which follow, subject to the restrictions stated therein. (A unit is a course of study covering a school year of not less than thirty-five weeks with four or five periods of at least forty-five minutes each per week.) No one under 21 years of age* will be admitted on less than 13 units.

(A) ENGLISH GROUP

Two units are required in this group. An applicant presenting one unit in this group will be admitted *conditionally,* if his arrearage in all of the groups does not exceed two units. All arrearages must be made good within two years after admission. Preparation in excess of two units in this group may be offered in lieu of the extra units of group (E).

English Composition and Rhetoric	1 unit
English Classics	1 unit
English Literature	1 unit

(B) HISTORY GROUP

Two units are required in this group. An applicant presenting one unit in this group will be admitted *conditionally,* if his arrearage in all of the groups does not exceed two units. All arrearages must be made good within two years after admission. Preparation in excess of two units in this group may be offered in lieu of the extra units of group (E).

Civil Government	½ unit
United States History	½ unit
General History	½ or 1 unit
Greek and Roman History	½ or 1 unit
English History	½ unit

---

*A person twenty-one years of age, or over, who desires to pursue a special line of work and does not desire to becomes a candidate for a degree, may be admitted by vote of the Executive Committee to such classes as he is qualified to enter; provided, that if he afterwards becomes a candidate for a degree he must pass the requirements for admission at least one year before the degree is conferred. See "Admission to Special Studies."

(C) MATHEMATICS GROUP

Three units are required in this group. An applicant presenting *two and one-half* units in this group will be admitted *conditionally*. if his arrearage in all of the groups does not exceed two units. All arrearage must be made good within two years after admission.

Algebra (through quadratics)	1 unit
Algebra (beyond quadratics)	½ unit
Geometry (plane)	1 unit
Geometry (solid and spherical)	½ unit

(D) SCIENCE GROUP

Two units are required in this group, including physics. An applicant presenting one unit in this group will be admitted *conditionally,* if his arrearage in all of the groups does not exceed two units. All arrearages must be made good within two years after admission. Preparation in excess of two units in this group may be offered in lieu of the extra units of group (E).

Physics	1 unit
Physical Geography	½ unit
Botany	½ unit
Chemistry	1 unit
Physiology	½ unit
Zoology	½ unit
Geology	½ unit
Astronomy	½ unit

(E) FOREIGN LANGUAGE GROUP

Six units are required in this group; or two *extra* units from the preceding groups, and *four* units from this. A deficiency of *two* units is allowed in this group if the total arrearage in all of the groups does not exceed *three* units. All arrearages must be make good within two years after admission.

Applicants who have had not less than two years of technical experience acceptable to the executive committee may have such experience substituted for not more than two units of the entrance requirements in foreign languages.

Latin	2 to 4 units
Greek	2 to 4 units
German	2 to 4 units
French	2 to 4 units
Spanish	2 to 4 units

A modern language is preferred, but Latin and Greek will be accepted. Those entering college with Latin or Greek will be required to begin a modern language in the first year of their course. Those entering with a modern language will be required to continue the same language in their first year.

An applicant twenty-one years of age or over who is deficient in foreign language training will be admitted with this deficiency in addition to the one unit permitted above; i. e., he may enter with a minimum of ten out of the fifteen units required.

The extent and character of the work required in each subject mentioned above is indicated on page 18 and following.

REMOVAL OF ENTRANCE CONDITIONS

All entrance conditions must be removed by examination under University officers before the beginning of the third year, except that Physics must be removed before the beginning of the second year. Certificates will not be received for entrance conditions after matriculation.

For those who have conditions in foreign language to remove, the following special arrangements will be made:

1. Those entering with a partial credit in Latin or Greek may make good their deficiency by doing an equivalent amount of work in a modern language in the college. For this work they will receive no college credit.

2. Those twenty-one years of age or over, entering with no training in language, may make good their deficiency by beginning a modern language in the college. For this work they will receive no college credit.

ADMISSION TO THE SHORT COURSES

Applicants must not be less than seventeen years of age, and, unless they are over twenty-one years of age must pass examinations in Arithmetic and Geography, and must be able to write a business letter or a short theme, correct in Grammar and Orthography; or they must present satisfactory certificates showing that they have successfully pursued these subjects elsewhere. In addition, each applicant under twenty-one years of age must present a letter or certificate showing that he has had at least one year's practical experience in some industry related to the course which he wishes to pursue.

Applicants over twenty-one years of age are admitted without examination, and without letter or certificate of practical experience.

ADMISSION WITH ADVANCED STANDING

Applicants for admission with advanced standing must first satisfy the entrance requirements in the ways described. By presentation of satisfactory certificates, or by examination, they may then obtain any advanced credits to which they are entitled.

Applicants who have successfully completed at least one year's work in an approved college, and who bring official and explicit certificates describing their course of study and scholarship, and also certificates of honorable dismissal, will be admitted without examination and without entrance conditions.

ADMISSION TO SPECIAL STUDIES

Students who desire to pursue special lines of work in the University, and do not desire to become candidates for degrees, will be admitted on the following conditions:

1. The regular entrance requirements must be satisfied.

But applicants who are not less than twenty-one years of age, after obtaining credit for elementary or "grade" work, and for such other subjects as may be necessary to qualify them for the classes that they wish to enter, may, on the presentation of satisfactory reasons, be admitted by the joint action of the Entrance Board and the Executive Committee of the College, to any class in the College; provided, that if any student who has been admitted on these conditions afterwards becomes a candidate for a degree, he shall take the omitted entrance examinations at least two academic years before the degree is conferred.

2. On entering the College, students desiring to pursue special work are required to lay before the Faculty, for approval or modification, a written statement of the end they have in view, the studies proposed for the attainment of that end, and the probable period of

attendance. Such students will be held as strictly to their accepted schemes of work as are the regular undergraduates to their courses of study.

3. Permission to enter as special undergraduates will be refused to all who fail to give satisfactory evidence of definiteness of purpose and will be withdrawn whenever the conditions on which it was granted cease to exist.

DESCRIPTION OF SUBJECTS ACCEPTED FOR ADMISSION TO THE COURSES LEADING TO DEGREES

(A) ENGLISH GROUP

English Composition and Rhetoric. One unit. Each applicant must be able to write clear and correct English, and no applicant will be accepted in English whose work is seriously defective in spelling, punctuation, grammar, and paragraph structure. The proper preparation for this part of the requirement is practise in composition through the four preparatory years, with correction of themes by the teacher and revision by the pupil. Subjects for themes should be taken from the books prescribed for general reading below and also from the pupil's observation and experience. Practise should be afforded in writing narrative, description, exposition and argumentation. Applicants should be familiar with those principles of Rhetoric which are most helpful in elementary composition; viz., the principles of sentence structure, outlining, paragraphs, and choice of words. The amount and kind of work required is indicated in Scott and Denney's Elementary Composition and Composition-Literature.

English Classics. One unit. (a) A thorough knowledge of the subject-matter, form, and structure of Shakespere's Macbeth, Milton's Lycidas, Comus, L'Allegro, Il Penseroso; Burke's Speech on Conciliation with America (or Washington's Farewell Address and Webster's First Bunker Hill Oration); Macaulay's Life of Johnson (or Carlyle's Essay on Burns. (b) A general knowledge of the substance of ten books selected from the following groups: Group 1 (two to be selected), Shakespere's As You Like It, Julius Cæsar, Merchant of Venice, Twelfth Night, Henry the Fifth; Group 2 (one to be selected), Bunyan's Pilgrim's Progress, part 1; Bacon's Essays, The Sir Roger de Coverley Papers in the Spectator, Franklin's Autobiography; Group 3 (one to be selected), Chaucer's Prologue, selections from Spenser's Faerie Queene, Pope's Rape of the Lock, Goldsmith's Deserted Village, Palgrave's Golden Treasury, first series, books ii and iii, with especial attention to Dryden, Collins, Gray, Cowper, and Burns; Group 4 (two to be selected), Hawthorne's House of the Seven Gables, Thackeray's Henry Esmond, George Eliot's Silas Marner, Dickens' A Tale of Two Cities, Scott's Ivanhoe, Quentin Durward, Goldsmith's Vicar of Wakefield, Mrs. Gaskell's Cranford, Blackmore's Lorna Doone; Group 5 (two to be selected), Emerson's Essays (selected), Ruskin's Sesame and Lilies, Irving's Sketch Book, Carlyle's Heroes and Hero Worship, DeQuincey's Joan of Arc and the English Mail Coach, Lamb's Essays of Elia; Group 6 (two to be selected), Palgrave's Golden Treasury, first series, book iv., with especial attention to Wordsworth, Keats, and Shelley, Coleridge's Ancient Mariner, Lowell's Vision of Sir Launfal, Scott's Lady of the Lake, Poe's Poems, Tennyson's Gareth and Lynette, Lancelot and Elaine, The Passing of Arthur, Arnold's Sohrab and Rostum, Byron's Mazeppa, The Prisoner of Chillon, Macaulay's Lays of Ancient Rome, and Browning's Cavalier Tunes, Lost Leader, How They Brought the Good News, Evelyn Hope, Home Thoughts from Abroad, Home Thoughts from the Sea, Incident of the French Camp, The Boy and the Angel, One Word More, Herve Riel, Pheidippides.

ENGLISH LITERATURE. One unit. A good knowledge of the leading facts in the history of English Literature, as given in Scudder's English Literature, Johnson's History of English and American Literature or the Introductions by Pancoast, Painter, Halleck, or Newcomer; together with the reading of representative works of literature. This may be offered in lieu of the work in English Classics.

(B) HISTORY GROUP

CIVIL GOVERNMENT. One-half unit. A good knowledge of the origin, principles, forms and powers of the national, state, and local governments is expected. Fiske's Civil Government, with a special study of the state from which the student comes, may serve to indicate the amount and kind of knowledge sought.

UNITED STATES HISTORY. One-half unit. A good knowledge of the main facts and features of American History, especially of the period since 1750, is expected. McLaughlin's History of the American Nation, Montgomery's Student's American History or Hart's Essentials in American History will serve to show the kind and amount of knowledge sought. No credit upon certificate will be accorded in this subject for work done below the ninth grade.

General History or Mediaeval and Modern History. One unit or one-half unit. Adams' European History or Harding's

Botany. One-half unit. Equivalent of the work outlined in an elementary text-book (such as Coulter's, Bailey's, Bergin's, Andrews', Leavitt's, Kellerman's) and of a small hand book of the local flora (Kellerman's Spring Botany), which requires one-half year.

Chemistry. One unit. McPherson and Henderson's Elementary Study of Chemistry, and "Exercises in Chemistry" arranged to accompany the same, or the equivalent. The course should consist of at least three recitations and four hours of laboratory work weekly.

Physiology. One-half unit. Martin's Human Body (Briefer Course). No credit will be accorded in this subject for work done below the ninth grade.

Zoology. One-half unit. Jordan, Kellogg, and Heath's Animal Studies; Kellogg's "Elementary Zoology"; Davenport's "Introduction"; or equivalents, with laboratory or field work.

Geology. One-half unit. Brigham's, Dana and Rice's (revised), Tarr's, or LeConte's may be used as texts. The recitations should be supplemented by study of the geological phenomena and formations found in the vicinity of the school.

Astronomy. One-half unit. Young's Lessons, Comstock's, or an equivalent.

(E) FOREIGN LANGUAGE GROUP

Latin. First unit. Pronunciation (Roman method); Grammar (an exact knowledge of the inflections). Second unit. Cæsar, the first four books of the De Bello Gallico. Third unit. Cicero, six orations of Cicero, including Pro Lege Manilia. Fourth unit. Vergil, the first six books of the Aeneid with Prosody; and Prose Composition, Daniel, or Collar, or Bennett, or Dodge and Tuttle, entire. Latin cannot be continued as a university study unless at least three units are offered for admission. Pupils should be trained to the systematic use of the grammar from the outset.

(Read the following after the fifth line on page 20.)

GENERAL HISTORY or MEDIAEVAL AND MODERN HISTORY. One unit or one-half unit. Adams' European History or Harding's Essentials in Mediæval and Modern History, Myers' Mediæval and Modern History (revised), or an equivalent.

GREEK AND ROMAN HISTORY. One-half or one unit. Botsford's Ancient History for Beginners, or West's Ancient World, or Wolfson's Essentials in Ancient History, or an equivalent.

ENGLISH HISTORY. One-half unit. Higginson and Channing's English History for Americans, or Walker's Essentials in English History, or Cheyney's Short History of England, or an equivalent.

(C) MATHEMATICS GROUP

ALGEBRA. One unit. Taylor's Elements of Algebra, or an equivalent. Special attention should be given to the four fundamental operations (single and system), factoring, highest common factor, lowest common multiple, fractions and fractional equations, involution, evolution, surds, complex quantities, quadratic equations solved by factoring, by completing the square and the general formula.

ALGEBRA. One-half unit. A thorough review of the work above named, irrational equations, simultaneous quadratic equations, higher equations solvable by factoring, ratio, proportion, progressions, theory of exponents, binominal theorem for positive integral exponents, and use of five-place tables of logarithms. It is recommended that this work be taken in the last year of the high school course.

GEOMETRY. One unit. Venable, White, Wells, Wentworth, Beman and Smith, or an equivalent. Plane geometry with solution of originals.

GEOMETRY. One-half unit. Solid and spherical geometry, with solution of originals given in the text-books named above.

(D) SCIENCE GROUP

PHYSICS. One unit. Carhart and Chute's Eelements, Gage's Elements, Avery's Elements, or an equivalent. Four recitation periods per week, including drill on simple numerical problems is recommended. A laboratory period of not less than two hours per week, to accompany the work of the text-book, is strongly urged, but is not required for the present.

PHYSICAL GEOGRAPHY. One-half unit. Tarr's, Dryer's, Davis', or Gilbert and Brigham's Physical Geography.

GREEK. First unit. Grammar (Goodwin's preferred) and Prose Composition; or White's First Greek Book. Second unit. Reading: The first three books of Xenophon's Anabasis. A third unit will be allowed for preparation in the fourth, fifth, and sixth books of the Anabasis and three books of Homer's Iliad, and a fourth unit for additional reading in Greek.

GERMAN. Two units. The pupil must possess a good pronunciation and be able to read or to translate at sight easy narrative prose, showing an exact and ready knowledge of the declensions and conjugations of the language. The ordinary principles of syntax and of word-order must be thoroughly mastered and such knowledge shown by the ability to translate easy sentences into German. Some three hundred pages of simple prose and poetry must be read.

Four units. In addition to the above, the applicant must have had two years more of instruction, including the reading of from four to five hundred pages of standard prose and at least one of Schiller's dramas, with not less than fifty pages of work in prose composition.

FRENCH. Two units. Applicants should be able to pronounce French accurately, to read at sight easy French prose, to put into French simple English sentences taken from the language of everyday life or based upon a portion of the French text read, and to answer questions on the rudiments of the grammar as defined below. During the first year the work should comprise: (1) Careful drill in pronunciation; (2) the rudiments of grammar, including the inflection of the regular and the more common irregular verbs, the plural of nouns, the inflection of adjectives, participles, and pronouns; the use of personal pronouns, common adverbs, prepositions, and conjunctions; the order of words in the sentence and the elementary rules of syntax; (3) abundant easy exercises, designed not only to fix in the memory the forms and principles of grammar, but also to cultivate readiness in the reproduction of natural forms of expression; (4) the reading of from 100 to 175 duodecimo pages of graduated texts, with constant practise in translating into French easy variations of the sentences read (the teacher giving the English), and in reproducing from memory sentences previously read; (5) writing French from dictation. During the second year the work should comprise: (1) The reading of from 250 to 400 pages of easy modern (nineteenth century) prose in the form of stories, plays or historical or biographical sketches; (2) constant practise, as in the previous year, in translating into French easy variations upon the texts read; (3) frequent abstracts, sometimes oral and sometimes written, of portions of the text already read; (4) writing French from dictation; (5) continued drill upon the rudiments of grammar, with constant application in the construction of sentences; (6) mastery of the forms and use of pronouns, pronominal adjectives, of all but the rare irregular verb forms, and of the simpler uses of the conditional and subjunctive.

Four units. In addition to the above, the applicant should be able to read at sight, with the help of a vocabulary of special or technical expressions, difficult French not earlier than that of the seventeenth century; to write in French a short essay on some simple subject connected with the words read; to put into French a passage of easy English prose and to carry on a simple conversation in French.

SPANISH. Two units. Applicants should be able to pronounce Spanish accurately, to read at sight easy Spanish prose, to put in Spanish simple English sentences taken from the language of everyday life or based upon a portion of the Spanish text read, and to answer questions on the essentials of the grammar. The first year should be spent mainly on the grammar with easy reading and oral practise; the second devoted to reading good modern Spanish, with grammatical analysis and exercises in writing. The texts read should be chiefly narrative and conversational prose, including one or more prose dramas of the present age.

Four units. In addition to the above, the applicant should be able to read at sight, with the help of a vocabulary of special or technical expressions, difficult Spanish, whether prose or poetry; to write in Spanish a short essay on some simple subject connected with the works read, which shall show a thorough knowledge of syntax; to put into Spanish a passage of easy English prose, and to carry on a simple conversation in Spanish.

LIST OF ACCREDITED AND RECOGNIZED SCHOOLS IN OHIO

Accredited schools are those four-year secondary schools whose courses of study have been found by inspection to be capable of satisfactorily preparing students for all colleges of the University.

Recognized schools are those three or four-year secondary schools whose courses of study are not capable of preparing students for all colleges of the University, but which have been found by inspection to cover satisfactorily 10 units of the requirements for admission.

These lists are subject to change from year to year as schools are revisited. Persons are advised, therefore, to consult the latest bulletins and catalogues of the University. A shows that a school is accredited; R, that it is recognized.

School	Superintendent	Principal
Akron, A	H. V. Hotchkiss	D. C. Rybolt
Alliance, R	J. E. Morris	J. W. Guthrie
Arcanum, R	C. E. Thomas	E. C. Bussert
Andover, R	S. A. Harbourt	Mary McDonald
Ashland, A	E. P. Dean	F. C. Clark
Ashtabula, A	E. O. Hotchkiss	Lillian Kurtz
Ashville, R	Stanley Lawrence	
Athens, A	F. S. Coultrap	Zella Foster
Baltimore, R	J. H. Horton	J. J. Wagner
Barberton, R	J. M. Carr	G. M. Korns
Barnesville, A	W. R. Butcher	A. J. Gerber
Batavia, R		
Bedford, R	J. E. Pettit	Mary E. Hopkinson
Bellaire, A	J. R. Anderson	Alice Cunningham
Bellefontaine, A	J. W. MacKinnon	Annie A. Price
Bellevue, R	E. F. Warner	H. C. Bates
Bethel Township, Clark Co., R	Alfred Ross	Irene Dornblaser
Bethel Township, Miami Co., R	R. W. Crist	Walter Peoples
Blanchester, R	C. L. Leahy	
Bluffton, R		
Bowling Green, A	N. D. O. Wilson	
Bryan, A	J. W. Wyandt	Orville Smith
Bucyrus, A	J. J. Bliss	C. H. Miller
Cadiz, R	J. R. Lehmann	S. L. Eby
Caldwell, R	C. J. Foster	Patrick Henry
Cambridge, A	H. Z. Hobson	John H. Harding
Camden, R	J. L. Fortney	L. D. Brouse
Canal Dover, A	F. P. Geiger	A. J. Huffman
Canal Winchester, R	J. R. Clements	Alma Jennings

School	Superintendent	Principal
Canton, A	John K. Baxter	Chas. A. Armstrong
Carey, R	A. J. Nowlan	Mattie Myers
Carthage, R	C. A. Wilson	Louise Sherrer
Celina. R	S. Wilkin	J. W. Pogue
Chargrin Falls, R	D. M. McGlenen	E. C. Teare
Chardon, A	W. R. Davis	Jessie King
Chillicothe, A	M. E. Hard	W. H. Rice
Cincinnati—	F. B. Dyer	
Franklin School (Cincinnati), A		Joseph E. White Gerrit S. Sykes
Hughes, A		E. W. Coy
Walnut Hills, A		W. T. Harris
Woodward, A		E. D. Lyon
Cin. Tech. School, A		F. M. Ballou
Circleville, A	C. L. Boyer	T. Otto Williams
Cleveland—	W. H. Elson	
Cleveland Heights, A	C. A. Tilden	C. A. Tilden
Central, A		Edward L. Harris
East, A		B. U. Rannells
Lincoln, A		James W. McLane
South, A		G. A. Reutenik
West, A		C. L. Lynch
Glenville, A		H. H. Cully
Clintonville, R	S. T. Price	W. S. Jennings
Clyde, A	Arthur H. Wicks	Lela B. Gilbert
College Corner, R	Eli P. Wilson	C. E. Gillespie
Collinwood, A	Frank P. Whitney	F. C. Rulon
Columbus—	Jacob A. Shawan	
Central, A		W. M. Townsend
East, A		F. B. Pearson
North, A		C. D. Everett
South, A		C. S. Barrett
Columbus School for Girls, A		Miss G. L. Jones Miss Alice Gladden
Columbus Grove, R	J. T. Begg	
Conneaut, R	Calvin T. Northrop	Louise E. Kahler
Corning, R		
Coshocton, A	Herman S. Piatt	W. L. Richer
Covington, R	L. J. Bennett	D. H. Sellers
Cumberland, R	G. E. Bell	W. S. Kingston
Cuyahoga Falls, R		Clinton Stauffer
Dayton, A	J. W. Carr	Chas. L. Loos, Jr.
Defiance, R	F. E. Reynolds	
Delaware, A	W. McK. Vance	Maude I. Myers
Delphos, A	T. W. Shimp	J. I. Miller
Delta, R	G. W. Hoffman	Viola Wilkins
DeGraff, R	N. H. Stull	
Dennison, R	W. H. Angel	A. J. Fry
Dresden, R	E. E. Smock	Blanche E. Baker
East Cleveland, A	W. H. Kirk	

School	Superintendent	Principal
East Liverpool, A	R. E. Rayman	Florence Updegraff
Eaton, A	J. R. Beachler	John O'Leary
Elyria, A	W. R. Comings	H. M. Ebert
Euclid, R	H. D. Rankin	Mary E. Gould
Findlay, A	J. W. Zeller	J. F. Smith
Fort Recovery, R	James Ross	(Mrs.) J. A. Hunter
Fostoria, A	S. H. Layton	Ida McDermott
Fredericktown, R	W. W. Borden	Anna B. Beattie
Fremont, A	J. E. Collins	E. A. Seibert
Friends' Boarding School (Barnesville), R		B. J. Thomas
Galion, A	I. C. Guinther	Louise John
Gallipolis, A	H. E. Conard	Morris A. Henson
Garrettsville, R	E. F. Robison	
Geneva, R		
Georgetown, A	A. F. Waters	Susan Cockerill
Germantown, A	C. W. McClure	S. M. Heitz
Gibsonburg, R	J. F. Young	Mary E. Baker
Glendale, A	E. H. Foster	
Grand River Institute, A		O. J. Luethi
Granville, R	Lee W. McKinnon	Flora Hoover
Greenfield, A	E. W. Patterson	Roy Harris
Greenville, A.	W. S. Rowe	J. L. Selby
Grove City, R	A. C. Fries	C. F. Neiswander
Groveport, R	W. E. Sealock	Jennie Lewis
Hamilton, A	Darrell Joyce	W. P. Cope
Harmony Township (Clark Co.), R	David Neer	Carlton Henry
Hartwell, A	J. S. Trisler	J. C. Mauckley
Harrison, R	Thos. P. Pierce	Mary A. Curran
Harrison Twp. (Montgomery Co.), R	D. W. Klepinger	Arthur E. Clagett
Hicksville, R	J. M. Beck	C. C. Nardin
Hilliards, R	Chauncey Lawrence	J. B. Phillips
Highland, R	C. W. Johnson	Bessie L. Smith
Hillsboro, A	F. H. Warren	W. E. Arter
Home City, R	J. O. Falkenburg	Inez M. White
Ironton, A	S. P. Humphrey	T. Howard Winters
Jackson, A	J. E. Kinnison	J. C. Boyd
Jefferson, A	H. S. Foote	Mary I. Hoskins
Kent, R	A. B. Stutzman	Amy Herriff
Kenton, A	N. E. Hutchinson	H. E. Giles
Kingsville, R	P. S. Kingsbury	
Kirtland, R	E. L. Beck	
Lakeside, A	J. E. Ockerman	
Lakewood, A	J. M. H. Frederick	H. W. Kennedy
Lancaster, A	H. A. Cassidy	

School	Superintendent	Principal
Lebanon, R	J. M. Hamilton	L. F. Coleman
Leetonia, R	J. W. Moore	Wynonah Thompson
Leipsic, R	W. S. Sackett	Florence B. McClure
Lima, A	J. A. Davidson	S. Steffens
Lisbon, R	W. O. Lambert	W. C. Dyer
Lockland, A	S. T. Dial	Howard Hollenbach
Logan, A	H. F. Silverthorn	Katherine A. Bowlby
London, A	Wm. McClain	Marion Schlesinger
Lorain, R	A. C. Eldredge	D. J. Boone
Madison, R	Geo. C. Von Beseler	Lois Ellet
Madison Township (Pickaway Co.), R		
Madisonville, A	C. M. Merry	(Mrs.) J. M. Bryan
Mad River Township (Enon Village), R	J. R. Clark	O. P. Hause
Malta, R	John B. Conrad	(Mrs.) E. W. Bradley
Mansfield, A		Harland E. Hall
Marietta, A	J. V. McMillan	C. E. Reed
Marion, A	H. L. Frank	
Martins Ferry, A	L. E. York	H. W. Paxton
Marysville, A	L. B. Demorest	Wm. I. Hill
Massillon, R	C. L. Cronebaugh	L. S. Hopkins
Mechanicsburg, A		J. W. Bowen
Medina, A	J. R. Kennon	Fannie E. Thomson
Miamisburg, A	W. T. Trump	Hardy Jackson
Middletown, A	Arthur Powell	Geo. C. Stahl
Mt. Sterling, R	T. F. Leonard	Cathryn Webber
Mt. Vernon, A	J. S. Alan	R. E. Offenhauer
Napoleon, R	P. C. Zemer	F. W. Leist
Nelsonville, A	Aaron Grady	O. C. Jackson
Newark, A	J. D. Simkins	T. O. Williams
New Bremen, R	C. F. Limbach	J. O. Erwin
New Lexington, R	J. M. Gordon	G. A. Elliot
New London, A	W. H. Mitchell	Stella M. Townsend
New Lyme Institute, A		H. C. White
New Philadelphia, A	G. C. Mauer	G. A. Wyly
New Richmond, R		
New Vienna, R	W. C. Hutchinson	
Niles, R	F. J. Roller	W. H. C. Newington
North Baltimore, R	B. O. Martin	S. L. Eby
Norwalk, R	A. D. Beechy	James E. Cole
Norwood, A	W. S. Cadman	W. W. McIntire
Oak Harbor, R	H. H. Hoffman	(Mrs.) Sarah R. Gill
Oberlin, A	Ward Nye	Howard L. Rawdon
Oberlin Academy, A		J. F. Peck
Ohio Military Institute, R	A. M. Henshaw	S. P. C. Roberts
Orrville, R		
Osborne, R	A. F. Darby	
Ottawa, R	G. J. Keinath	

School	Superintendent	Principal
Oxford Col. Acad., A	Jane Sherzer	Catharine Cox
Painesville, A	F. H. Kendall	A. H. Mabley
Pandora (Riley Township), R	C. E. Steiner	
Pataskala, R	F. M. Heston	J. C. Evans
Perrysburg, R	C. E. Stinebaugh	Olive Woodard
Piqua, A	C. W. Bennett	F. E. C. Kirkendall
Plain City, R	J. S. Edwards	
Pleasant Ridge, R	F. L. Simmerman	
Pomeroy, R	C. T. Coates	Dollie Hooper
Port Clinton, R	C. S. Wheaton	Lillian C. Smith
Portsmouth, A	J. I. Hudson	Frank Appel
Quaker City, R	W. G. Wolfe	J. O. Eagleson
Ravenna, R	E. O. Trescott	W. J. Dodge
Reynoldsburg, R	Arthur L. Gantz	Wm. S. Coy
Richwood, R	Forest B. Bryant	W. E. Shrader
Ripley, R	R. B. Smith	John W. Thalman
Sabina, R	M. J. Flannery	T. C. Madden
Salem, A	J. S. Johnson	B. F. Stanton
Salineville, R	Frank Linton	W. H. Hannum
Sandusky, R	H. B. Williams	Geo. C. Dietrich
Shelby, A	S. H. Maharry	C. H. Winans
Sidney, A	Herbert R. McVay	Lee R. Dollenger
Solon, R	U. S. Earls	Charlotte Parker
Somerset, R	J. W. Davis	E. R. Beck
South Charleston, R		Stanley Zemer
Spencerville, R	Thos. J. Class	E. S. Bolton
Springfield, A	Carey Bogess	C. C. Patterson
Steubenville, A	E. M. Van Cleve	W. H. Maurer
St. Mary's, A		
St. Paris, R	D. C. Bryant	Florence Hunter
Tiffin, A	C. A. Krout	H. H. Frazier
Tippecanoe City, R	Orville Crist	E. R. Rike
Toledo, A	C. L. Van Cleve	Wm. B. Guitteau
Troy, A	C. W. Cookson	G. F. M. Mark
Uhrichsville, R	L. E. Everett	C. W. Jackson
Union City (Ind.), A		
Urbana, A	I. N. Keyser	H. N. Morton
Urbana Univ., A		Russel Eaton
Ursuline Acad. (Brown Co.), R		Sister M. Baptista
Upper Sandusky, R	R. J. Kiefer	Glenn E. True
Utica, R	F. P. Householder	
Van Wert, A	J. P. Sharkey	Orrin Bowland
Wadsworth, R		W. A. Franks
Wapakoneta, R	H. H. Helter	Mary O. Conrath
Warren, A	C. E. Carey	F. E. Ostrander
Washington C. H., A	James T. Tuttle	

School	Principal	Superintendent
Wauseon, A	C. J. Biery	H. O. Hannah
Waverly, R	J. F. Henderson	G. W. Caldwell
Wellington, A	R. H. Kinnison	Elizabeth Day
Wellston, A	E. S. McCall	J. W. Whiteside
Wellsville, A	J. L. MacDonald	Ruby C. Mason
Westerville, R	J. P. West	J. F. Nave
West Alexandria, R	F. E. Rinehart	Clara Smith
West Jefferson, R	L. C. Dick	
West Milton, R	F. B. Harris	Mary E. Thomas
West Unity, R	W. A. Salter	Adah Weiser
Willoughby, R	S. D. Shankland	Edward M. Ottis
Wilmington, R	E. P. West	F. D. Blair
Woodsfield, R	C. S. McVey	
Wooster, A	D. L. Thompson	Laura B. Kean
Worthington, R	Harvey S. Gruver	J. J. McDonald
Wyoming, A	C. S. Fay	Evelyn M. Prichard
Xenia, A	Edwin B. Cox	Geo. J. Graham
Youngstown, A	N. H. Chaney	Wells L. Griswold
Zanesville, A	W. D. Lash	Ira C. Painter

ACCREDITED SCHOOLS OF OTHER STATES

COLORADO—Canon City; Cripple Creek; Denver—West Side, North Side; Durango; Golden; Grand Junction; Greeley; Idaho Springs; Leadville; Longmont; Loveland; Trinidad.

ILLINOIS—Alton; Aurora—East, West; Bloomington; Blue Island; Champaign; Chicago—Austin, Calumet, Curtis, Englewood, Hyde Park, Jefferson, John Marshall, Joseph Medill, Lake, Lake View, North West Div. (Tuley), R. T. Crane (Man. T'g), Robert A. Waller, South Chicago, Wendell Phillips, William McKinley; Chicago Heights; Clyde (Morton Tp.); Danville; Decatur; De Kalb Tp.; Dixon; Elgin; Elgin Academy; Evanston Academy (N. W. Univ.); Evanston Tp.; Francis W. Parker; Freeport; Harvey (Thornton Tp.); Highland Park (Deerfield Tp.); Joliet Tp.; Kankakee; Kewanee; La Grange Tp.; La Salle-Peru Tp.; Moline; New Trier Tp. (Kenilworth); Northwestern Medical Academy; Oak Park Tp.; Ottawa Tp.; Peoria; Polo; Pontiac Tp.; Princeton Tp.; Quincy; Rockford; Rock Island; Savanna Tp.; Springfield; Sterling Tp.; Streator Tp.; Waukegan Tp.

INDIANA—Elkhart; Evansville; Fort Wayne; Goshen; Howe School (Lima); Michigan City; Shortridge (Indianapolis); South Bend.

IOWA—Boone; Burlington; Cedar Rapids; Clinton; Corning; Council Bluffs; Davenport; Denison; Des Moines—East, North, West; Dubuque; Fort Dodge; Grinnell; Ida Grove; Iowa City; Keokuk; Le Mars; Marshalltown; Mason City; Missouri Valley;

Oskalooso; Ottumwa; Red Oak; Sheldon; Sioux City; Vinton; Washington; Waterloo—East, West.

Kansas—Arkansas City; Fort Scott; Iola; Junction City; Kansas City; Lawrence; Leavenworth; Sumner Co. (Wellington); Topeka; Wichita.

Michigan—Adrian; Albion; Alpena; Ann Arbor; Battle Creek; Bay City (East Side); Bay City (West Side); Benton Harbor; Benton Harbor Col. Inst.; Bessemer; Cadillac; Calumet; Coldwater; Detroit — Central, Delray, Eastern, Western, Woodmere, Home and Day, University; Dowagiac; Escanaba; Ferris Institute; Flint; Grand Rapids; Hancock; Holland; Houghton; Ionia; Ironwood; Iron Mountain; Ishpeming; Jackson; Kalamozaa; Lake Linden; Lansing; Manistee; Manistique; Marshall; Marquette; Menominee; Michigan Military Academy; Michigan Seminary; Monroe; Muskegon; Mt. Clemens; Mt. Pleasant; Negaunee; Owosso; Pontiac; Port Huron; Saginaw (East Side); Saginaw (West Side); Sault Ste. Marie; South Haven; St. Johns; St. Joseph; Three Rivers; Traverse City; Wyandotte.

Minnesota—Albert Lea; Anoka; Austin; Crookston; Duluth Central; Faribault; Fergus Falls; Hastings; Little Falls; Mankato; Marshall; Minneapolis—Central, East, North; Montevideo; Northfield; Owatonna; Rochester; St. James; St. Paul—Central, Humboldt; Stillwater; Virginia; Willmar.

Missouri—Blees Military Academy (Macon); Booneville; Carrollton; Chillicothe; Drury College Academy; Kansas City—Central, Manual Training, Westport; Kemper Military School; Kirkwood; Macon; Marysville; St. Louis—Central, McKinley, Smith Academy, Yeatman; St. Joseph; Sedalia; Trenton; Webster Groves.

Nebraska—Beatrice; Brownell Hall; Fremont; Grand Island; Hastings; Lincoln Academy; Lincoln; Omaha; South Omaha; York.

North Dakota—Fargo; Grand Forks.

South Dakota—Aberdeen; Deadwood; Mitchell; Watertown; Yankton.

Wisconsin—Antigo; Appleton; Ashland; Baraboo; Beaver Dam (Wayland Academy); Beloit; Berlin; Chippewa Falls; Eau Claire; Elkhorn; Fond du Lac; Grand Rapids; Hartford; Janesville; Kenosha; La Crosse; Lake Geneva; Madison; Maniotowoc (North); Marinette; Marshfield; Menomonie; Merrill; Milwaukee—East Division, South Division, West Division; Milwaukee-Downer Seminary; Oshkosh; Plymouth; Portage; Racine; Racine Col. Grammar School; Reedsburg; Ripon; Sheboygan; Stevens Point; Superior, Blaine; Superior, Nelson Dewey; Tomah; Washburn; Waukesha; Waukesha (Carroll College Academy); Waupaca; Wausau; Wauwatosa; Whitewater.

COURSES OF STUDY

All engineering education is based on the constant use of the fundamental sciences, mathematics, physics, and chemistry, supplemented by training in the art of expression by both language and drawing. It naturally follows that all engineering courses start from a common point, proceed side by side for a time, but specialize and subdivide more and more as they progress toward completion, until in the last year they present but little work in common.

Further, it is very commonly the case with young men entering college for a technical education, that they are following ambitions not founded on any knowledge of their own natural aptitudes or capacities, and that they are in no way prepared to make a wise or final selection of their life work at that time.

For these two reasons the work of the first year is made identical in all of the engineering courses leading to a degree. The student is enrolled as a "First-year Engineer." His selection of the course he wishes to pursue is deferred to the latter part of his first year, by which time he has become acquainted to some extent with University standards and methods, with the scope of the various courses offered, and with his own tastes and powers.

OUTLINE OF THE FIRST YEAR'S WORK OF ALL FOUR-YEAR COURSES

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

FIRST TERM.		SECOND TERM.		THIRD TERM.	
Mathematics (31) Algebra.	5.	Mathematics (32) Trigonometry.	5.	Mathematics (33) Analytics.	5.
Chemistry (7 or 44) Inorganic	5.	Chemistry (7 or 44) Inorganic.	5.	Chemistry (12 or 45) Qualitative Analysis.	4.
Modern Language French, Ger. or Span.	4.	Modern Language French, Ger. or Span.	4.	Modern Language French, Ger. or Span.	4.
English (1) Composition.	2.	English (1) Composition.	2.	English (1) Composition.	2.
Drawing (27) Freehand.	2.	Drawing (25) Freehand.	1.	Drawing (26) Freehand.	1.
		Drawing (31) Geometric.	1.	Drawing (32) Lettering.	2.
Military Drill.		Military Drill, Gymnasium.		Military Drill.	

Students presenting Chemistry as an entrance subject will take Chemistry 44 and 45.

SUMMER TERM IN SHOPWORK—Students electing courses named below are required to take Shopwork courses in the summer term as follows:

Chemical Engineering—Shopwork (7) and (11), at the close of the first or second year.

Ceramics, Electrical Engineering, and Mechanical Engineering—Two from Shopwork (4), (7), and (11), at the close of the first year.

Industrial Arts—Shopwork (7) and (11), at the close of the first year.

COURSE IN ARCHITECTURE

This course is designed to combine with Architecture as a fine art a thorough training of those phases of engineering which deal with the problems of construction that must be solved before a building can be erected.

Drawing is an important factor in the education of the architect, including that of the artist and of the engineer. The following courses indicate the training in this subject:—freehand drawing from models and plaster casts, brush drawing from cast, still life and out-door sketching, pen drawing, clay modeling, photography, geometric drawing, lettering, mechanical drawing, descriptive geometry, shades and shadows and architectural perspective.

The history of architecture is taught by lectures, reference reading, and recitations, being freely illustrated by a selected set of lantern slides which familiarizes the student with the architecture of the past. Parallel with the history of architecture is a course of drawing which is devoted to the details of the "Orders" of architecture, Romanesque and Renaissance, thereby fixing firmly in mind the characteristics of each.

Decoration and ornament are taught by lectures and practise, consideration being given to the different styles of architecture in both form and color. Closely allied to this is a study of the principles of architectural composition, given by lectures and assigned problems.

Architectural design consists of preparing the necessary drawing, specifications, and estimates, for proposed structures, such as may be encountered in the practise of first-class professional architects.

The engineering and technical training comprises the following: Mathematics, mechanics, strength of materials, stresses in trusses and framed structures, steel skeleton construction and fireproofing for tall buildings, heating and ventilating, sanitary plumbing, masonry, concrete construction, and testing of materials.

FOR OUTLINE OF FIRST YEAR SEE PAGE 31.

SECOND YEAR

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

FIRST TERM.		SECOND TERM.		THIRD TERM.	
Drawing (33) Projections.	3.	Drawing (36) Descriptive Geom.	5.	Architecture (26) Arch. Perspective.	5.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Architecture (9) His. of Architecture.	3.	Architecture (10) His. of Architecture.	3.	Architecture (11) His. of Architecture.	3.
Architecture (12) Detail Drawing.	2.	Architecture (13) Detail Drawing.	2.	Architecture (14) Detail Drawing.	2.
Drawing (14) Pen Drawing.	2.				
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

THIRD YEAR

Mechanics (1) Statics.	5.	Mechanics (2) Str'n'th Mat'ls, Kinet.	5.	Architecture (24) Framing Details.	2.
Architecture (22) Arch. Composition.	2.	Architecture (23) Designing.	4.	Architecture (17) Designing.	4.
Drawing (7) Photography.	2.	Drawing (40) Clay Modeling.	2.	Drawing (41) Clay Modeling.	2
Architecture (15) Designing.	4.	Drawing (18) Water Color Paint'g.	2.	Drawing (19) Water Color Paint'g.	3.
Architecture (5) Decorations, etc.	3.	Civil Eng. (6) Stereotomy.	4.	Civil Eng. (19) Trusses.	5.
English (3) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.

FOURTH YEAR

Architecture (18) Designing.	4.	Architecture (4) Specifications.	2.	Architecture (6) Estimates and Supt.	4.
Civil Eng. (34) Masonry.	3.	Architecture (25) Plumbing.	2.	Architecture (19) Designing.	4.
Mech. Eng. (23) Materials of Const.	4.	Architecture (21) Designing.	2.	Architecture (20) Thesis.	5.
Geology (2) General.	5.	Civil Eng. (28) Steel Construction.	5.	Civil Eng. (21) Surveying.	3.
		Civil Eng. (29) Cement Testing.	3.		
		Mech. Eng. (42) Heating, Vent.	3.		

THESIS

COURSE IN CERAMICS

The ceramic industries include, according to the classification here adopted, those in which the production and utilization of natural and artificial silicates is the end in view; viz, clayware, glass, and cement. These three industries constitute a natural division of chemical technology.

Ceramic Engineering is the application of chemical technology and general engineering to this special group of non-metallic mineral industries. The ceramic engineer is supposed to be enough of a geologist to inspect a tract of country and determine whether it possesses mineral resources suited to silicate manufacture, and enough of a mining engineer to be able to economically win the deposits found, whether they are to be quarried superficially or mined deep in the earth. He must be enough of a mechanical engineer to transport, prepare, and manufacture these substances into their appropriate forms, rapidly and cheaply. Above all, he must be enough of a chemist to understand the nature of the processes taking place in kilns and furnaces, both as regards the generation of heat, and the formation of new silicate minerals from the earthy raw materials. The intimate relation existing between the composition and properties of silicate products throughout all ceramic operations, and the use of chemical control for maintaining these relations constant, make the training of the chemical laboratory absolutely necessary to the safe and progressive management of any modern ceramic industry.

These demands are broad and varied, but not more so than those of chemical engineering in general. The field of ceramic engineering is comparatively new in this country, the first course being offered in 1896. The demand for trained men in these industries is not yet as firmly established as in the well-known engineering branches, and ceramic engineers are compelled to a certain extent to act as pioneers in the field. Their employment on a constantly increasing scale is regarded as certain.

FOR OUTLINE OF FIRST YEAR SEE PAGE 31.

SUMMER TERM—Students are required to take *two* of the following courses in shopwork in the summer term at the close of the first year: Shopwork (4), (7), and (11).

SECOND YEAR

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

FIRST TERM.		SECOND TERM.		THIRD TERM.	
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (39) Drafting, etc.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Physics (3) Problems.	2.	Physics (3) Problems.	2.	Physics (3) Problems.	2.
Ceramics (1) Laboratory.	5.	Ceramics (2) Laboratory.	5.	Ceramics (3) Laboratory.	5.
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

THIRD YEAR

Mechanics (1) Statics.	5.	Mechanics (2) Str'n'th Mat'ls, Kinet.	5.	Mechanics (3) Kinetics, Hydraulics	5.
Ceramics (4) Raw Materials.	5.	Ceramics (5) Clay Products.	5.	Ceramics (6) Clay Products.	5.
Mine Eng. (4) Mine Surveying.	5.	Mech. Eng. (37) Mechanism.	4.	Ceramics (7) Adv. Laboratory.	5.
English (3) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.

FOURTH YEAR

Ceramics (9) Manf. of Bodies.	5.	*Ceramics (10) Glasses and Glazes.	5.	*Ceramics (11) Enamels, Colors.	5.
Metallurgy (4) Fuels and Iron.	5.	*Ceramics (12) Cement.	5.	*Ceramics (18) Cement Laboratory.	5.
Geology (2) General.	5.	Ceramics (22) Lectures and Lab.	3.	Ceramics (15) Thesis Work.	5.
		Geology (6) Economic.	3.	Mech. Eng. (36) Laboratory.	5.
		Geology (7) Petrography.	2.		
Drawing (7) Photography.	2.	Drawing (22) Technical Draw.	2.	Drawing (23) Technical Draw.	2.

THESIS

*Students are to elect Ceramics (10) and (11) or Ceramics (12) and (18).

COURSE IN CHEMICAL ENGINEERING

This course has been prepared to meet the growing demands for trained men in the numerous industries which are based upon chemical processes or employ them prominently in their work, and which are not included in the fields of metallurgy and ceramics. Among such may be mentioned the manufacture of acids, alkalies, salts, chemical reagents, paints, colors, dyes, bleaching powders, soaps, glue, gelatin, glycerine, tanning compounds, starch, sugar, dextrine, glucose, alcohol, ferments, preservatives, antiseptics, fertilizers, matches, and many others.

Much of this work has been done in the past without the aid of the chemist. At present it is recognized, however, that in order to carry on the work economically and compete with other countries, the service of the chemist is indispensable. Not only is he able to improve the methods and obtain better products, but he is often able to devise methods for utilizing the by-products and thus lower the cost of production.

The course differs from the ordinary course in chemistry in that it is extended greatly along the engineering lines. This is in accord with the views of the manufacturers as well as experts in technical chemistry. The manufacturer must not only understand the chemical reactions involved in processes; he must be able to devise machinery for carrying out these reactions on a large scale. Nearly all chemical industries are conducted by the aid of elaborate plants for mechanically treating the materials and handling the products, which in many cases cannot be dealt with by hand labor. Consequently mechanical engineering, and to a limited extent, electrical engineering, is demanded and used in these industries. The men at present entering these lines of work are largely mechanical engineers, well trained in this side of the work, but weak and inefficient on the chemical side, which is really fundamental.

FOR OUTLINE OF FIRST YEAR SEE PAGE 31.

SUMMER TERM—Shopwork Courses (7) 3 and (11) 3 are to be taken in the summer term at the close of the first or second year.

SECOND YEAR

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

FIRST TERM.		SECOND TERM.		THIRD TERM.	
Chemistry (20)	4.	Chemistry (20)	4.	Chemistry (20)	4.
Chemistry (21)	2.	Chemistry (21)	2.	Chemistry (21)	2.
Physics (2)	3.	Physics (2)	3.	Physics (2)	3.
Mathematics (41)	5.	Mathematics (42)	5.	Mathematics (43)	5.
Drawing (33)	3.	Drawing (34)	3.	Metallurgy (2)	3.
Chemistry (40)	1.	Chemistry (40)	1.		
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

THIRD YEAR

English (3)	2.	English (3)	2.	English (3)	2.
Mechanics (1)	5.	Mechanics (2)	5.	Mechanics (3)	5.
Drawing (21)	2.	Drawing (22)	2.	Drawing (23)	2.
Chemistry (46)	2.			Mech. Eng. (32)	5.
Chemistry (47)	2.				
Metallurgy (4)	5.				
*Optional Work. GROUP I.		Chemistry (46)	2.	Chemistry (46)	2.
		Chemistry (47)	2.	Chemistry (47)	2.
		Chemistry (15)	4.		
*Optional Work. GROUP II.		Metallurgy (4)	5.		
		Metallurgy (6)	5.	Metallurgy (5)	5.

*Students wishing to specialize in metallurgical chemistry will elect Group II as their option; all others will elect Group I.

FOURTH YEAR

Chemistry (32)	4.	Chemistry (32)	4.	Chemistry (71)	4.
Mech. Eng. (18)	5.	Mech. Eng. (18)	5.	Mech. Eng. (19)	5.
Chemistry (30)	3.	Chemistry (30)	3.		
Elec. Eng. (7)	2.				
Elec. Eng. (6)	2.				
*Electives Including Thesis.	2.	*Electives Including Thesis.	6.	*Electives Including Thesis.	9.

*These electives must be approved by the head of the Department of Chemistry, or in case of those students specializing in metallurgical chemistry, by the head of the Department of Metallurgy.

COURSE IN CIVIL ENGINEERING

Among the special fields which are usually included under the title Civil Engineering, are those of Bridge Engineering, Railroad Construction and Maintenance of Way, Sanitary Engineering, Public Water Supply and Irrigation Engineering, and other special branches, such as Topographic and Geodetic Surveying.

The course of instruction is designed to provide the foundation upon which all of these specialties are built. The first two years are, therefore, devoted to the fundamental sciences, to drawing, and to mensuration, and afford an excellent short course in Surveying for those expecting to become deputy county surveyors, or to engage in private practise as land surveyors.

During the third and fourth years, attention is turned to engineering proper, and the drafting and sciences studied during these years apply directly to the art of construction as practised in each of the specialties of highway, railway, masonry, bridge, sanitary, and hydraulic engineering.

To keep the course in close touch with practise, the department attempts to make each graduate proficient with the instruments of his profession by requiring attendance at Summer surveying camp for two terms of four weeks each, at the end of the second and third years, or submitting suitable experience with some practising engineer in lieu thereof; by means of work in well-equipped laboratories; and by completing a satisfactory thesis on some practical theme. Much valuable training is to be had from suitable thesis work, and students are urged to begin this during their third year, or the vacation following.

The laboratories of the department include facilities for extended work in investigating cements and reinforced concrete, for investigating road materials, and for rating meters and doing other hydrographic work. The remaining laboratories of the college give the student facility in testing other materials of construction, and familiarize him with the elements of steam and electrical engineering practise.

FOR OUTLINE OF FIRST YEAR SEE PAGE 31.

SECOND YEAR

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

FIRST TERM.		SECOND TERM.		THIRD TERM.	
Drawing (33) Projections.	3.	Drawing (36) Descriptive Geom.	5.	Drawing (35) Shades, Shadows.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Civil Eng. (30) Surveying.	5.	Civil Eng. (4) Topog. Drawing.	4.	Civil Eng. (32) Railroad Surveying.	5.
Civil Eng. (31) Field Practise.	1.			Civil Eng. (33) Field Practice.	1.
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

SUMMER COURSE—Civil Engineering (22) 4 weeks, of 6 days per week. Field work in surveying.

THIRD YEAR

Mechanics (1) Statics.	5.	Mechanics (2) Str'n'th Mat'ls, Kinet.	5.	Mechanics (3) Kinetics, Hydraulics.	5.
Civil Eng. (3) Topog. Surveying.	4.	Civil Eng. (24) C. E. Drawing.	5.	Civil Eng. (7) Bridge Stresses.	5.
Civil Eng. (16) Roads and Streets.	5.	Civil Eng. (6) Stereotomy.	4.	Drawing (7) Photography.	2.
Astronomy (4) Mathematical.	3.	Astronomy (5) Mathematical.	3.	Astronomy (6) Mathematical.	4.
English (3) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making ,etc.	2.

SUMMER COURSE—Civil Engineering (23) 4 weeks, of 6 days per week. Field work in advanced surveying.

FOURTH YEAR

Civil Eng. (8) Bridge Designing.	5.	*Civil Eng. (17) Railways.	5.	Civil Eng. (18) Water Supply.	5.
Civil Eng. (34) Masonry Constr.	3.	*Civil Eng. (25) Adv. Bridge Work.	5.	Civil Eng. (10) Sanitary Eng.	5.
Elec. Eng. (6 & 7) Lectures and Lab.	4.	Civil Eng. (14) Cement Testing.	2.	Civil Eng. (35) Masonry Structures.	3.
		Mech. Eng. (17) Laboratory.	3.	Mech. Eng. (25) Laboratory.	5.
Geology (2) General.	5.	Geology (6) Economic.	3.		

THESIS

*Students are to elect either Civil Engineering (17) or Civil Engineering (25).

COURSE IN ELECTRICAL ENGINEERING

The object of this course is to give such training as shall enable the graduate to successfully take up practical work in those branches of engineering in which electricity plays the principal part. In general, the training needed for this purpose is similar to that of the mechanical engineer, except that the student is not expected to become expert in all the fields of mechanical engineering, but must have a good knowledge of the whole subject of power generation, transmission, and transformation, especially in its electrical form.

The constantly widening field wherein electrical methods are being adopted is making an ever-increasing demand for the graduates of technical colleges. Among the industries where electricity is coming into use, perhaps none is more far-reaching or important than electric railroading. Furthermore, the substitution of electricity upon steam roads is beginning, and it would be a bold man who would set a limit to the progress of this movement. Akin to the above is the use of electric power for the transmission of material over short distances, as in the case of mines, shop railway cranes, etc. The driving of machine shops by electricity, although it has become the standard method and is being installed in all new shops of importance, has yet a wide field for development. In the telephone industry both the manufacturing and operating companies are calling for technical graduates in ever larger numbers, and the engineering side of this work offers a field than which there is perhaps none more interesting. To the electrical engineering graduate there are opened up several different kinds of work. The manufacturers have long required many men for their engineering, commercial, and manufacturing departments; a newer and large field is now opening up among the different operating companies, and there are also positions with construction and commercial companies.

FOR OUTLINE OF FIRST YEAR SEE PAGE 31.

SUMMER TERM—Students are required to take *two* of the following courses in shopwork in the summer term at close of first year: Shopwork (4), (7), and (11).

SECOND YEAR

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

FIRST TERM.		SECOND TERM.		THIRD TERM.	
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43 Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y', Magnetism.	3.	Physics (2) Light, Sound.	3.
Physics (3) Problems.	2.	Physics (3) Problems.	2.	Physics (3) Problems.	2.
Shop (4, 7, or 11)	3.	Shopwork (13) Machine Work.	3.	Physics (5) Laboratory.	4.
English (3) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

THIRD YEAR

Mechanics (1) Statics.	5.	Mechanics (2) Str'n'th Mat'ls, Kinet.	5.	Mechanics (3) Kinetics, Hydraulics.	5.
Physics (6) Laboratory.	5.	Physics (6) Laboratory.	5.	Mech. Eng. (32) Power Plants.	5.
Physics (4) Elect'y, Magnetism.	3.	Mech. Eng. (37) Mechanism.	4.	Mech. Eng. (28) Laboratory.	2.
Shopwork (14) Machine Work.	3.	Elec. Eng. (8) D. C. Machinery.	4.	Elec. Eng. (9) Laboratory.	4.
Drawing (5) Technical.	3.			Elec. Eng. (15) A. C. Machinery.	2.

Elec. Eng. (20), (21), (22), or (23) is taken at the end of the winter term.

FOURTH YEAR

Elec. Eng. (16) A. C. Machinery.	3.	Elec. Eng. (17) A. C. Machinery.	2.	Elec. Eng. (19) Designing.	4.
Elec. Eng. (11) Laboratory.	3.	Elec. Eng. (11) Laboratory.	3.	Elec. Eng. (11) Laboratory.	3.
Mech. Eng. (33) Engines and Boilers.	5.	Elec. Eng. (18) Elec. Design.	3.	Elec. Eng. (25) Transmission.	2.
Mech. Eng. (29) Laboratory.	3.	Elec. Eng. (24) Applications.	2.	*Elec. Eng. (26) Railways.	3.
		Mech. Eng. (30) Laboratory.	2.	*Elec. Eng. (27) Telephony.	3.
		Ind. Arts (9) Mach. Design.	2.	*Elec. Eng. (28) Illumination.	3.
**Elective	3-5.	**Elective	3-5.	**Elective	3-5.

Elec. Eng. (20), (21), (22), or (23) is taken at the end of the winter term.

THESIS

*Alternative Course.

**Subject to the approval of the professor of Electrical Engineering.

COURSE IN INDUSTRIAL ARTS

This course is designed for those who may desire to occupy positions in the various branches of manufacture, not as engineers, but as practical managers, superintendents or business men.

As the growth of engineering has brought about its subdivision into many special lines, such as civil, mechanical, electrical, mining, and chemical engineering, and established special training for each, so the increase in size, importance, and scope of the manufactures of the country has made it desirable to especially train young men with reference to filling positions of trust and responsibility in them; to so educate them that they can readily learn the treatment or processes in any special line of manufacture and be able to intelligently superintend; and can initiate and put into successful operation new industrial enterprises.

With this idea in view, this course has been planned to give the student special training along industrial and business lines, together with a certain amount of general culture. There will be found in this course a large amount of science training by which the processes of manufacture based upon these laws may be more readily understood; practise in the different shops and in drawing, so that a good working knowledge of such operations may be acquired, as well as training given to eye and hand, and power of observation and thought developed along mechanical lines; studies into the principles and methods governing the production of the chief materials of construction, the different mechanical movements and their combinations in machinery, the use of materials in various constructions, electrical machinery and steam power plants, together with laboratory practise; also the relations of capital and labor, the problems of trade, and the conduct of business enterprises.

FOR OUTLINE OF FIRST YEAR SEE PAGE 31.

SECOND YEAR

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

FIRST TERM.		SECOND TERM.		THIRD TERM.	
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Physics (3) Problems.	2.	Physics (3) Problems.	2.	Physics (3) Problems.	2.
Mathematics (41)	5.	Shopwork (9) Adv. Pattern M'king.	3.	Shopwork (4) Adv. Forging.	3.
Shopwork (3) Foundry.	2.	Economics (33) Ele. of Pol. Econ.	3.	Economics (33) Ele. of Pol. Econ.	3.
Economics (33) Ele. of Pol. Econ.	3.	Economics (57) American Industries.	3.	Economics (57) American Industries.	3.
Military Drill,		Military Drill.		Military Drill.	
Gymnasium.					

THIRD YEAR

Drawing (5) Technical.	3.	Ind. Arts (2) Designing.	3.	Ind. Arts (2) Designing.	3.
Ind. Arts (1) Tools and Machines.	3.	Ind. Arts (1) Tools and Machines.	3.	Ind. Arts (1) Tools and Machines.	3.
Shopwork (13) Chipping and Filing.	3.	Shopwork (14) Machine Work.	3.	Shopwork (15) Machine Work.	3.
Metallurgy (4) Fuels and Iron.	5.	Metallurgy (4) Steel.	2.	Mech. Eng. 32) Power Plants.	5.
English (3)	2.	Economics (48) Ele. of Pol. Econ.	2.	Economics (48) Ele. of Pol. Econ.	2.
Economics (48)	2.	Civil Eng. (27) Timber and Masonry.	3.	English (3)	2.
		English (3)	2.		

FOURTH YEAR

Shopwork (16) Adv. Mach. Work.	3.	Elec. Eng. (6) Lectures.	2.	Shopwork (17) Adv. Mach. Work.	3.
Elec. Eng. (6) Lectures.	2.	Elec. Eng. (7) Laboratory.	2.	Civil Eng. (21) Surveying.	3.
Elec. Eng. (7) Laboratory.	2.	Ind. Arts (3) Shop Appliances.	3.	Ind. Arts (3) Shop Management.	3.
Ind. Arts (3) Shop Equipment.	3.	Ind. Arts (4) Adv. Designing.	3.	Ind. Arts (4) Adv. Designing.	3.
Ind. Arts (4) Adv. Designing.	3.	Mech. Eng. (29) Laboratory.	2.	Mech. Eng. (30) Laboratory.	2.
Mech. Eng. (12) Laboratory.	2.	Economics (38) Ind. Concen., etc.	3.	Economics (39) Lab. Organ., etc.	3.
Economics (37) Ind. Org'nizat'n, etc.	3.	Elective	3.		

THESIS

COURSE IN MANUAL TRAINING

This course is designed for those who wish to become teachers of manual training in the public schools of secondary grade or in technical schools. It is necessary that a teacher of manual training in the public schools be of the same high standard as his associates in character, general culture, and uplifting influence. He must possess knowledge of the methods of instruction and ability in the art of teaching; and coupled with these, he must have skill in his technical lines. He must be familiar with the tools, materials, and processes used, and acquainted with the different effects on his pupils of the training and work with these. He must understand that enlarged power and ability in the student is what he is seeking; that the pupil himself and not the inanimate object used is the real product of his efforts.

The value of manual training as a needed factor in the education of modern days is recognized. In the old times, when so many machine-made articles were not in the market, and living was not so diversified, the children of the family received their manual training at their homes and under their parents as teachers. There were the household duties assigned to them and things to be made and repaired and ideas of improvements to be wrought out. These were done with a good deal of hand work, and a valuable training was obtained. Now this training is brought about by the introduction of manual work into the schools from the lowest to the highest grades. In the higher grades the materials used in the manual training are those in common use, wood and iron; and the principles underlying the working of them in the various industries are studied and practised.

As the work is arranged in the course offered, the student is well grounded in the sciences of mathematics, physics, and chemistry, and can plan his manual training work to help more directly the other lines of work of his pupils.

FOR OUTLINE OF FIRST YEAR SEE PAGE 31.

SECOND YEAR

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

FIRST TERM.		SECOND TERM.		THIRD TERM.	
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Physics (3) Problems.	2.	Physics (3) Problems.	2.	Physics (3) Problems.	2.
Shopwork (7) Woodwork.	3.	Shopwork (9) Adv. Pattern M'k'g.	3.	Shopwork (8) Cabinet Work.	3.
Shopwork (3) Foundry.	3.	Shopwork (11) Forging.	3.	Shopwork (12) Adv. Forging.	3.
English (3) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.
Education (1) Elem. Psychology.	3.	Education (1) Elem. Psychology.	3.	Education (1) Elem. Psychology.	3.
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

THIRD YEAR

Drawing (5) Technical.	3.	Ind. Arts (2) Designing.	3.	Ind. Arts (2) Designing.	3.
Ind. Arts (1) Tools and Machines.	3.	Ind. Arts (1) Tools and Machines.	3.	Ind. Arts (1) Tools and Machines.	3.
Shopwork (4) Chipping, Filing.	3.	Shopwork (13) Machine Work.	3.	Shopwork (14) Machine Work.	3.
History (1) U. S. Political.	3.	History (1) U. S. Political.	3.	History (1) U. S. Political.	3.
*Chemistry (20) Quantitative.	4.	*Chemistry (20) Quantitative.	4.	*Chemistry (20) Quantitative.	4.
*Chemistry (21) Physical.	2.	*Chemistry (21) Physical.	2.	*Chemistry (21) Physical.	2.
*Physics (5) Laboratory.	5.	*Physics (5) Laboratory.	5.	*Physics (5) Laboratory.	5.

FOURTH YEAR

Shopwork (15) Adv. Mach. Work.	3.	Shopwork (16) Adv. Mach. Work.	3.	Mech. Eng. (32) Power Plants.	5.
Elec. Eng. (6) Lectures.	2.	Elec. Eng. (6) Lectures.	2.	Mech. Eng. (28) Laboratory.	2.
Elec. Eng. (7) Laboratory.	2.	Elec. Eng. (7) Laboratory.	2.		
Education (5) Science of Educ.	3.	Education (5) Science of Educ.	3	Education (5) Science of Educ.	3.
Polit. Science (1) Pol. Inst. of U. S.	3.				
Electives	2-5	Electives	5-7	Electives	5-7

THESIS

*Students take either Chemistry (20) and (21) or Physics (5).

COURSE IN MECHANICAL ENGINEERING

Mechanical engineering deals with the generation of power from the forces of nature and the utilization of this power in machinery by means of mechanism for the manufacture of different products. Physics is the fundamental science underlying this profession, especially those parts of physics relating to mechanics and heat. Chemistry is required for understanding the constitution of the materials used and for the changes which take place during combustion. Mathematics is the tool by which scientific principles are made applicable to practical engineering problems.

One of the great fields of mechanical engineering is the generation of power by means of the steam boiler, steam engine, and steam turbine. The great advances of the past century have been made possible by improvements in these lines. Recently a rival has sprung up for steam; the field of gas engineering, which includes the manufacture and utilization of fuel in gaseous form directly in the engine, will probably furnish sweeping changes in the generation of power. The utilization of water power and the power of the wind also form fields for the mechanical engineer. The application of the power, whatever its manner of generation, can be had either directly by pumps, air compressors, and electrical machinery, or indirectly through shafting, belting, and ropes. These applications furnish other opportunities. The machinery called for and designed by the mechanical engineer includes all that is used in the different industrial establishments, from the large machines found in rolling mills, steel works, and other manufacturing establishments to the delicate machinery used in the manufacture of watches. Still another branch includes such allied subjects as heating, ventilation, and refrigeration.

The training given is designed to equip men with such general and technical knowledge that they can take up the work in any of the branches of the profession.

FOR OUTLINE OF FIRST YEAR SEE PAGE 31.

SECOND YEAR

SUMMER TERM—Students are required to take *two* of the following courses in shopwork in the summer term at the close of the first year: Shopwork (4), (7), and (11).

FIRST TERM.		SECOND TERM.		THIRD TERM.	
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect"y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Shopwork (3) Foundry.	2.	Physics (7) Laboratory.	2.	Physics (7) Laboratory.	3.
English (3) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.
Shopwork (4, 7, 9, or 11)	3.	Shopwork (4, 9, or 11)	3.	Shopwork (13) Machine Work.	3.
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

THIRD YEAR

Mechanics (1) Statics.	5.	Mechanics (2) Str'n'th Mat'ls, Kinet.	5.	Mechanics (3) Kinetics, Hydraulics.	5.
Mech. Eng. (12) Laboratory.	2.	Mech. Eng. (3) Mechanism.	5.	Mech. Eng. (3) Mechanism.	2.
Drawing (5) Technical.	3.	Civil Eng. (27) Timber. Masonry.	3.	Drawing (7) Photography.	2.
Metallurgy (4) Fuels and Iron.	5.	Metallurgy (4) Steel.	2.	Civil Eng. (19) Trusses.	5.
Shopwork (14) Machine Work.	3.	Shopwork (15) Adv. Machine Work.	4.	Mech. Eng. (32) Power Plants.	5.
Mathematics (11') Diff. Equations.	1.				

Mech. Eng. (38), (39), (40), or (41) is taken at the end of the winter term.

FOURTH YEAR

Mech. Eng. (33) Engines and Boilers.	5.	Mech. Eng. (34) Thermodynamics.	5.	Mech. Eng. (21) Thesis.	5.
Mech. Eng. (27) Laboratory.	5.	Mech. Eng. (14) Laboratory.	4.	Mech. Eng. (15) Laboratory.	3.
Mech. Eng. (18) Machine Design.	5.	Mech. Eng. (18) Machine Design.	5.	Mech. Eng. (19) Machine Design.	5.
Elec. Eng. (6) Lectures.	2.	Elec. Eng. (6) Lectures.	2.	Mech. Eng. (31) Hydraulic Mach.	3.
Elec. Eng. (7) Laboratory.	2.	Elec. Eng. (7) Laboratory.	2.	Ind. Arts (5) Shop Appliances.	3.

THESIS

Mech. Eng. (38), (39), (40), or (41) is taken at the end of the winter term.

COURSE IN MINE ENGINEERING

The professon of mine engineering involves two distinct fields, tnat of the engineer and that of the metallurgist. A man may devote himself to either of these departments, but a competent understanding of both is essential to the successful designing and development of mining or metallurgical plants.

On the engineering side the work is directed to the excavation and working of mineral resources. In this are involved the geological features of the locality; the opening of the property; the mechanical handling of the ores or coal; the surveying and mapping of the mining operations, and the proper drainage and ventilation of the mine.

In its metallurgical aspects, mine engineering is confined to the reduction of the metals from their ores, the manufacture and alloying of the metals, and the treatment and utilization of fuels from the standpoint of the effective generation of a calorific power rather than the conversion of the power to other forms of energy.

The professional outlook for the mine engineer is good. The development of coal mining has given rise to a considerable demand for trained men to have charge of the engineering work involved and ultimately for the general management of the business. The widely distributed fields for the mining of metallic minerals and the special and somewhat isolated character of many of the plants, make the training of the mine engineer of special importance in their management. In connection with the larger reduction plants, with steel manufacture, and with iron blast furnaces, there is a growing demand for men trained as metallurgical chemists. The industries dealing with the treatment and smelting of ores are growing rapidly and are in need of trained men.

FOR OUTLINE OF FIRST YEAR SEE PAGE 31.

SECOND YEAR

FIRST TERM.		SECOND TERM.		THIRD TERM.	
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Metallurgy (5) Laboratory.	5.	Metallurgy (5) Laboratory.	5.	Metallurgy (5) Laboratory.	5.
Shopwork (7) Woodwork.	2.	Shopwork (11) Forging.	2.	Metallurgy (2) Mineralogy.	3.
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

THIRD YEAR

Mechanics (1) Statics.	5.	Mechanics (2) Str'n'th Mat'ls, Kinet.	5.	Mechanics (3) Kinetics, Hydraulics.	5.
Metallurgy (4) Fuels and Iron.	5.	Metallurgy (4) General.	5.	Metallurgy (3) Deter. Mineralogy.	5.
Mine Eng. (4) Mine Surveying.	5.	Metallurgy (6) Assaying.	5.	Civil Eng. (19) Trusses.	5.
English (3) Expository Writing.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.
		Mine Eng. (7) Surveying.	1.		

FOURTH YEAR

Mine Eng. (5) Mine Engineering.	5.	Mine Eng. (5) Mine Engineering.	5.	Mine Eng. (5) Mine Engineering.	5.
Geology (2) General.	5.	Geology (6) Economic.	3.	Mech. Eng. (36) Laboratory.	5.
Metallurgy (8) Ore Dressing.	2.	Metallurgy (7) Metal. Construction.	3.	Mine Eng. (6) Plans and Spec.	5.
Elec. Eng. (6) Lectures.	2.	Elec. Eng. (6) Lectures.	2.	Drawing (7) Photography.	2.
Elec. Eng. (7) Laboratory.	2.	Elec. Eng. (7) Laboratory.	2.		
		Geology (7) Petrography.	2.		

THESIS

COURSES NOT LEADING TO A DEGREE

The following short courses are offered by the University in the belief that they will meet the needs of a large class of young men who for some reason will not or cannot obtain the benefits of the thorough courses already described. The University recognizes that there are many valid reasons which may stand in the way of some, whose ability to receive and to use the highest forms of education is without question; and it is thought that in extending opportunities for such training as will be available to these young men, the University is filling a long felt want in the scheme of engineering education, and is certain to grow into closer contact with the industrial life of the State.

To one completing these courses, a certificate is issued stating the studies in which work has been satisfactorily done.

The requirements for admission to these short courses are very much lower than for admission to regular collegiate work. It is clear that to reach the young men for whom these courses have been designed, it is necessary that the conditions of admission and attendance shall be shorn of every complication and that the opportunity extended shall be within the grasp of all, and with the minimum of formality or restriction.

The somewhat elementary character of some of the work of these courses may attract the attention of some, who as candidates for admission to regular collegiate work, could not be admitted on account of their insufficient preparation. To all such students it is proper to state that these courses are in no sense designed as preparatory schools for those who desire ultimately to enter college, and it is not the purpose to permit such use to be made of them. For the detailed requirements for admission to these short courses see page 16.

SHORT COURSE IN CLAY-WORKING

The two-year course is designed to assist young men who have already been actively engaged in the Ceramic industries, and who, on account of mature years, or lack of means, or lack of previous educational advantages, are unable to avail themselves of the full and complete course, and yet who wish to increase their earning power or chances of promotion by fitting themselves for other than routine labor. This course comes into as close a touch with the wants of the clay industries as is possible in so brief a time. It is intended to make its benefits available to the greatest number.

FIRST YEAR

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

FIRST TERM.		SECOND TERM.		THIRD TERM.	
Chemistry (3) Inorganic.	5.	Chemistry (3) Inorganic.	5.	Chemistry (45) Quantitative.	5.
Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.
Mathematics (3) Plane Geom.	5.	Mathematics (13) Space Geom.	5.	Mathematics (14) Trigonometry.	5.
Drawing (2) Lettering.	3.	Drawing (38) Projections.	3.	Drawing (39) Drafting.	3.
Military Drill.		Military Drill, Gymnasium.		Military Drill.	

SUMMER TERM—Students are required to take Shopwork (7) and (11) in the summer term at the end of the first year. But they may be excused from this where they are able to obtain positions in some ceramic establishment for the summer; and on presentation of a satisfactory certificate, endorsed by the head of the department, work in a ceramic factory during the summer may be counted as equivalent to the summer shop course.

SECOND YEAR

FIRST TERM.		SECOND TERM.		THIRD TERM.	
Ceramics (1) Laboratory.	5.	Ceramics (2) Laboratory.	5.	Ceramics (19) Laboratory.	5.
Ceramics (4) Lectures.	5.	Ceramics (5) Lectures.	5.	Ceramics (6) Lectures.	5.
Physics (1) Elementary.	5.	Physics (1) Elementary.	5.	Ceramics (23) Laboratory.	7.
Ceramics (20) Laboratory.	2.	Ceramics (21) Laboratory.	2.		
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

SHORT COURSE IN INDUSTRIAL ARTS

This course is primarily designed to extend the benefits of the same kind of training as that given in the four-year course in this subject to that class of young men who may be unable for any reason to undertake a course of four year's duration, but who aspire to become actively engaged in factory work. It has been the aim to give, in as condensed form as possible, those studies which will most rapidly and easily be turned to practical account in manufacturing operations.

This course will be found most valuable to young men already engaged in factory work, who find themselves limited from rising in their work on account of lack of technical education.

FIRST YEAR

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

First Term.		Second Term.		Third Term.	
Drawing (24) Freehand.	1.	Drawing (25) Freehand.	1.	Drawing (26) Freehand.	1.
Drawing (2) Lettering.	3.	Drawing (38) Projections.	3.	Drawing (39) Drafting.	3.
Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.
Mathematics (3) Plant Geometry.	5.	Mathematics (13) Space Geometry.	5.	Mathematics (14) Trigonometry.	5.
Shopwork (7) Pattern Making.	3.	Shopwork (9) Adv. Pattern M'k'g.	3.	Shopwork (11) Forging.	3.
Military Drill.		Military Drill. Gymnasium.		Military Drill.	

SECOND YEAR

Ind. Arts (8) Machine Drawing.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Ind. Arts (1) Tools, Machines.	3.	Ind. Arts (1) Tools, Machines.	3.	Ind. Arts (1) Tools, Machines.	3.
Physics (1) Elementary.	5.	Physics (1) Elementary.	5.	Geology (1) Phys. Geography.	5.
Shopwork (4) Chipping, Filing.	3.	Shopwork (13) Machine Work.	3.	Shopwork (14) Adv. Machine Work.	3.
Shopwork (3) Foundry.	2.	Ind. Arts (2) Designing.	3.	Ind. Arts (2) Designing.	3.
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

SHORT COURSE IN MINING

The short course in mining is especially designed for young men who have had practical experience in mines and wish to study mine surveying, drafting, the problems of ventilation, drainage, haulage, mine operating, etc., and also something of the sciences bearing upon their work, but have neither time nor preparation for a full college course. The first year is devoted to a thorough study of the elementary mathematics and sciences necessary to prepare the student for the practical work of the second year. Experience has shown beyond any doubt that any enterprising young miner can master the subject sufficiently well in the time assigned to materially increase his earning capacity and chances for promotion in his occupation.

Personal instruction is given, and it is made thoroughly practical and of such a character as to best adapt it to the needs of the individual student.

FIRST YEAR

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

FIRST TERM.		SECOND TERM.		THIRD TERM.	
Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.
Mathematics (3) Geometry.	5.	Mathematics (13) Space Geometry.	5.	Mathematics (14) Trigonometry.	5.
Physics (1) Elementary.	5.	Physics (1) Elementary.	5.	Geology (1) Phys. Geography.	5.
Military Drill.		Military Drill, Gymnasium.		Military Drill.	

SECOND YEAR

Drawing (2) Lettering.	3.	Drawing (38) Projections.	3.	Drawing (39) Drafting.	3.
Drawing (27) Freehand.	2.	Geology (4) Elementary.	5.	Shopwork (11) Forging.	3.
Chemistry (3) Inorganic.	5.	Chemistry (3) Inorganic.	5.	Metallurgy (9) Mineral Chemistry.	5.
Mine Eng. (1) Mine Surveying	5.	Mine Eng. (2) Ventilat. Haulage.	5.	Mine Eng. (3) Mine Operating.	5.
		Mine Eng. (7) Surveying.	1.		
Military Drill, Gymnasium.		Military Drill.		Military Drill.	

DEPARTMENTS OF INSTRUCTION

ARCHITECTURE

(Office, Room 22, Brown Hall.)

PROFESSOR BRADFORD, ASSISTANT PROFESSOR CHUBB.

The department work in Architecture is carried on in Brown Hall. The well-lighted designing rooms are equipped with the needed tables, lockers, etc., and the lecture room is provided with an electric projection lantern. The department has much material for consultation and study, including models in plaster and wood illustrating the constructive and ornamental forms of different styles of architecture, photographs and lantern slides, drawings and specifications of erected structures, plates of architectural forms and ornaments, samples of building material. Various structures are continually in process of erection in the city and furnish examples of practical nature.

4. SPECIFICATIONS. Two credit hours. Architecture, fourth year, second term, *Tu., at* 11, and assigned work. Prerequisite, Architecture 18. Professor BRADFORD.

Lectures and practise in preparing specifications for architectural structures.

5. DECORATION AND ORNAMENT. Three credit hours. Architecture, third year, first term, *M., W.. at* 9; *F.,* 9 *to* 11. Prerequisite, Drawing 37 and Architecture 14. Professor BRADFORD.

Lectures on the different styles of carved ornament and decorative color. The practise part of this subject will be incorporated in the Clay-Modeling and Designing.

6. ESTIMATES AND SUPERINTENDENCE. Four credit hours. Architecture, fourth year, third term, *M., W., at* 8; *W.,* 1 *to* 5. Prerequisite, Architecture 21, Concurrent, Architecture 19. Professor BRADFORD.

Lectures and practise in preparing estimates for structures designed in 11, 12, 13 and 21, and the duties of superintendence.

9. HISTORY OF ARCHITECTURE. Three credit hours. Architecture, second year, first term, *M., W., F., at* 11. Professor BRADFORD.

Lectures illustrated by lantern slides.

10. Continuation of 9. Architecture, second year, second term, *M., W., F., at* 11. Professor BRADFORD.

11. Continuation of 10. Architecture, second year, third term, *M., W., F., at* 11. Professor BRADFORD.

12. ARCHITECTURAL DRAWING. Two credit hours. Architecture, second year, first term, *W., Th., F., 2 to* 4. Concurrent, Drawing 33 and Architecture 9. Professor BRADFORD.

Drawing architectural ornament, details of orders and styles, with the special object of impressing upon the student's mind the architectural characteristics considered.

13. Continuation of 12. Architecture, second year, second term, *W., Th., F., 2 to* 4. Concurrent, Architecture 10. Professor BRADFORD.

14. Continuation of 13. Architecture, second year, third term, *W., Th., F., 2 to* 4. Concurrent, Architecture 11. Professor BRADFORD.

15. DESIGNING. Suburban dwellings. Four credit hours. Lectures and practise. Architecture, third year, first term, *W., Th., 1 to* 4; *F., 1 to* 3. Prerequisite, Architecture 14, and Drawing 37. Professor BRADFORD.

17. DESIGNING. School buildings. Four credit hours. Architecture, third year, third term, *W., Th., 1 to* 4; *F., 1 to* 3. Prerequisite, Architecture 23. Professor BRADFORD.

18. DESIGNING. Public buildings. Four credit hours. Architecture, fourth year, first term, *Th., F., 1 to* 5. Prerequisite, Architecture 17. Professor BRADFORD.

19. DESIGNING. Ecclesiastical architecture. Four credit hours. Architecture, fourth year, third term, *Th., at* 11; *Th., F., 1 to* 4. Prerequisite, Architecture 21. Professor BRADFORD.

20. THESIS. Five credit hours. Architecture, fourth year, third term.

Original design to be accompanied with written description, specifications and estimate.

21. ARCHITECTURE OF TALL SKELETON-CONSTRUCTED BUILDINGS. Two credit hours. Architecture, fourth year, second term, *Th., at* 11; *F., 1 to* 3. Prerequisite, Architecture 18. Concurrent, Civil Engineering 28. Professor BRADFORD.

22. PRINCIPLES OF ARCHITECTURAL COMPOSITION. Two credit hours. Architecture, third year, first term, *Tu., Th., at* 9. Concurrent, Architecture 5. Professor BRADFORD.

23. Designing. Modern apartment houses. Four credit hours. Architecture, third year, second term, *W., Th., 1 to* 4; *F., 1 to* 3. Prerequisite, Architecture 15. Professor Bradford.

24. Framing Details. Two credit hours. Architecture, third year, third term, *F.*, 8 *to* 11. Prerequisite, Architecture 23. Professor Bradford.

25. Sanitary Plumbing. Two credit hours. Architecture, fourth year, second term, *M., F., at* 10.

Lectures on the principles of sanitary plumbing.

26. Architectural Perspective. Five credit hours. Third term.

AMERICAN HISTORY AND POLITICAL SCIENCE

(Office, University Hall, Room 207.)

PROFESSORS KNIGHT, SPENCER, AND MR.————

HISTORY

1. Political History of the United States. Three credit hours. Text-books and prescribed reading. Thwaites's The Colonies, Hart's Formation of the Union, Wilson's Division and Re-Union. Manual Training, third year, first, second and third terms, *M., W., F.,* 8 *or* 9.

POLITICAL SCIENCE

1. Political Institutions of the United States. Three credit hours. Manual Training, fourth year, first term, *M., W., F., at* 9. Prerequisite, American History 1.

Lectures and recitations. A study of the origin and nature of the political institutions of the United States, and an analysis of the form and powers of the government.

ASTRONOMY

(Office, Emerson McMillin Observatory.)

PROFESSOR H. C. LORD, MR. SMITH, MR. PARK.

The Observatory was founded in 1895 through the generosity of Mr. Emerson McMillin. The building and equipment are designed primarily for the purpose of instruction. The aim of the teaching is to give a mastery of the fundamental principles rather than to accumulate a mass of half-understood measurements. Ten students can work each clear night under the constant supervision of the instructor, the inconvenience of open air observations being reduced to a minimum.

4. ASTRONOMY, GEODESY, AND LEAST SQUARES. Three credit hours. Civil Engineering, third year, first term. Lectures, *M., W., F., at* 11. Laboratory hours arranged with the students individually. Prerequisite, Mathematics 43 and Physics 2. Professor LORD.

Lectures on practical astronomy, supplemented by practise with the instruments of the Emerson McMillin Observatory.

5. Continuation of 4. Three credit hours. Civil Engineering, third year, second term. Lectures, *M., W., F., at* 11. Laboratory, time to be arranged. Professor LORD.

6. Continuation of 5. Laboratory work. Four credit hours. Civil Engineering, third year, third term. Time to be arranged. Professor LORD.

CHEMISTRY

(Office, Chemical Hall.)

PROFESSOR MCPHERSON, EMERITUS PROFESSOR NORTON, ASSOCIATE PROFESSORS HENDERSON, FOULK, ASSISTANT PROFESSORS EVANS, WITHROW, MR. VOGT, MR. KNOTE, MR. MORRIS, AND DEPARTMENT FELLOWS.

The laboratories of the department accommodate about one thousand students. Each laboratory is equipped with all the necessary conveniences—water, gas, electric lights, distilled water, piped from a large still in the attic; steam ovens, automatic air blasts, suction pumps, etc. The department is liberally supplied with the best apparatus and materials for both lecture room and laboratory work. Each student has his own desk with drawers and locker. All supplies are procured from the chemical store-room which has on hand a complete stock of all necessary materials.

3. ELEMENTARY CHEMISTRY. Four credit hours. First and second terms. One lecture, one quiz, six hours laboratory work weekly. Lectures, *M., at* 10; quiz, *Th.,* 8 *or* 11. Laboratory, *M., Tu.,* 1 *to* 4, *or Th., F.,* 1 *to* 4. Assistant Professor EVANS, Assistant

Professor WITHROW, Mr. VOGT, Mr. MORRIS, and department fellows.

7. ELEMENTARY CHEMISTRY. Four credit hours. First and second terms. One lecture, one quiz, six hours laboratory work weekly. Lecture, *M., at* 8; quiz, *F., at* 8, 9, 10, 1, *or* 3. Laboratory *M., Tu.,* 9 *to* 12; *Th., F.,* 9 *to* 12; *M., Tu.,* 1 *to* 4; *Th., F.,* 1 *to* 4 or *W.,* 8 *to* 10; *S.,* 8 *to* 12. Assistant Professor EVANS, Mr. VOGT, Mr. MORRIS, and department fellows.

This course is arranged for students who have not presented chemistry as an entrance requirement. Students taking this course will follow with course 12, third term.

44. GENERAL CHEMISTRY. Four credit hours. First and second terms. First term: Lecture, *M., W., at* 3; quiz, *F., at* 8, 9, 10, 1 *or* 3. Laboratory, *Tu.,* 9 *to* 12; *F.,* 9 *to* 12; *F.,* 1 *to* 4, *or S.,* 8 *to* 11. Second term: Lecture, *M., at* 3; quiz, *F., at* 8, 9, 10, 1, 3. Laboratory, *M., Tu.,* 9 *to* 12; *Th., F.,* 9 *to* 12; *Th., F.,* 1 *to* 4, *or W.,* 8 *to* 10; *S.,* 8 *to* 12. Professor MCPHERSON, Associate Professor HENDERSON, Assistant Professor EVANS, Mr. VOGT, Mr. MORRIS, and department fellows.

This course is arranged for students who have had an acceptable course in elementary chemistry in a secondary school. Students taking this course will follow with course 12, the third term.

45. QUALITATIVE ANALYSIS. Four credit hours. Third term. One lecture, one quiz, six hours laboratory work weekly. Prerequisite, chemistry 3. Time same as chemistry 3. Assistant Professor EVANS, Assistant Professor WITHROW, Mr. VOGT, Mr. MORRIS, and department fellows.

This is a general elementary course in qualitative analysis, and is arranged for students in short courses only.

12. QUALITATIVE ANALYSIS. Four credit hours. Third term. One lecture, one quiz, six hours laboratory work weekly. Prerequisite, Chemistry 7 or 44. Lecture, *M.,* 8 *or* 3; quiz and laboratory at same time as Chemistry 7. Assistant Professor EVANS, Assistant Professor WITHROW, Mr. VOGT, Mr. MORRIS, and department fellows.

This is a general introductory course in qualitative analysis.

21. ADVANCED GENERAL CHEMISTRY. Two credit hours. First, second, and third terms. Two lectures weekly. *Tu., Th., at* 9. Prerequisite, Chemistry 7 or 44. Associate Professor HENDERSON.

This course consists of reviews and extends the work in general chemistry.

20. QUANTITATIVE ANALYSIS. Four credit hours. First, sec-

ond, and third terms. One lecture, nine hours laboratory work weekly. Lecture, *M., at* 1. Laboratory open afternoons. Prerequisite, Chemistry 12 or 37. Associate Professor FOULK, Mr. KNOTE.

First principles of gravimetric and volumetric analysis. This course must be accompanied by Chemistry 40, except by special permission of the instructor. It is also desirable that it should be accompanied by Chemistry 21.

40. CHEMICAL PROBLEMS. One credit hour. First and second terms. *Th., at* 11. Associate Professor FOULK.

Extended practise in the solution of chemical problems pertaining to analytical chemistry. This course is arranged to accompany Chemistry 20.

46. ORGANIC CHEMISTRY. Two credit hours. First, second, and third terms. Two lectures weekly. *Tu., Th., at* 8. Prerequisite, courses 20, and 21, except by special permission of the instructor. Professor MCPHERSON.

General course in organic chemistry. Whenever possible this course should be accompanied by Chemistry 47.

47. ORGANIC CHEMISTRY. Two or three credit hours. First, second, and third terms. Six or nine hours laboratory work weekly. Laboratory open afternoons. Professor MCPHERSON.

Preparation of typical organic compounds. This course must be accompanied or preceded by course 46.

15. SANITARY ANALYSIS. Four credit hours. Second term. Two lectures, four hours laboratory work weekly. Lectures, *Tu., Th., at* 10. Laboratory open afternoons. Prerequisite, Chemistry 20. Associate Professor FOULK.

A study of the methods of sanitary water analysis and the interpretation of results.

30. PHYSICAL CHEMISTRY. Three credit hours. First and second terms. Three lectures weekly. *M., W., F., at* 8. Prerequisite, Chemistry 20, 21; also course 46, except by special permission of the instructor. Associate Professor HENDERSON.

A general course in the theory of chemistry.

32. INDUSTRIAL CHEMISTRY. Four credit hours. First and second terms. Two lectures, six hours laboratory work weekly. *Tu., Th., at* 8. Laboratory, *W., Th.,* 1 *to* 4. Prerequisite, Chemistry 20. 21, 46, 47. Assistant Professor WITHROW.

Industrial applications of chemistry.

71. TECHNICAL ANALYSIS. Four credit hours. Third term. One lecture, nine hours laboratory work weekly. Lecture, *Tu., at* 11.

Laboratory open afternoons. Prerequisite, course 20. Associate Professor FOULK.

The chemical examination of various commercial products.

77. THE READING OF CHEMICAL LITERATURE. Two credit hours. First term. Time to be arranged. Prerequisite, German 1. Associate Professor FOULK.

The main obect of this course is to afford practise in the rapid reading of German chemical literature, the selections, being made with special reference to the technical terms of the science.

CIVIL ENGINEERING

(Office, Brown Hall, Room 33.)

PROFESSOR SHERMAN, PROFESSOR ENO, ASSOCIATE PROFESSOR MORRIS, ASSISTANT PROFESSOR SCHLAFLY, MR. CHAMBERLIN, MR. WARD.

The department is housed in Brown Hall. For drafting, three spacious and well-lighted drawing rooms are provided for the work of the second, third, and fourth-year students respectively. In each room is a collection of working drawings, prints, maps, etc., gathered from practising engineers, and arranged in suitable file-cases for the ready consultation of the students. A large blue-print room on the ground floor is equipped with electrical blue-print apparatus, in addition to the ordinary sunlight frames.

For field work the instruments are one high-grade transit, seventeen other transits fitted for various kinds of surveying, twelve leveling instruments, plane table, solar compass, two solar attachments, two high-grade aneroid barometers, two drainage levels, surveying camera, rods, chains, tapes, hand-levels, etc. Two current meters with accessories, and a rating course 175 feet long in the rear of the building furnish facilities for carrying on hydrographic work.

The cement-testing laboratory is fitted with necessary appliances for making the ordinary tests. It contains a Fairbanks tensile testing machine, briquette molds, sieves, apparatus for making hot tests, etc., and machine for testing plain and reinforced concrete beams.

The department also owns a complete outfit for carrying on the work of summer surveying in camp. Summer camp for 1905 was pitched in Yellowstone National Park, where the classes were engaged in surveying the road system. Summer camp for 1906 was pitched at Willoughby, O., where the students made surveys for sewerage, street, and other improvements.

3. TOPOGRAPHIC SURVEYING. Four credit hours. Lectures, field work, and drawing. Johnson's Surveying used for reference. Civil Engineering, third year, first term, *M., F., at* 10; *Tu., Th.,* 1 *to* 5, *S.,* 8 *to* 11, *or Tu., Th., at* 10; *M., W., F.,* 1 *to* 5. Prerequisite, Civil Engineering 2 and 22. Assistant Professor SCHLAFLY, Mr. CHAMBERLIN.

4. TOPOGRAPHICAL DRAWING. Four credit hours. Platting, pen and tinted work. Reed's Topographic Drawing and Sketching. Civil Engineering, second year, second term, *M., Tu.,* 1 *to* 4; *W.,* 1 *to* 3, *or Th., F.,* 2 *to* 4; *S.,* 8 *to* 12. Prerequisite, Drawing 26 and 32. Professor SHERMAN, Professor ENO.

6. STEREOTOMY. Four credit hours. Recitations, lectures and drawing. Warren's Stereotomy. Architecture and Civil Engineering, third year, second term, *M., F., at* 10; *S.,* 8 *to* 12, *or Tu., Th., at* 10; *S.,* 8 *to* 12. Prerequisite, Drawing 36. Professor SHERMAN, Assistant Professor SCHLAFLY, Mr. CHAMBERLIN.

7. BRIDGE STRESSES. Five credit hours. Recitations and lectures. Heller's Stresses in Structures. Civil Engineering, third year, third term, *M., Tu., W., Th., F.,* 8 *or* 9. Prerequisite, Mechanics 2. Associate Professor MORRIS.

8. BRIDGE DESIGNING. Five credit hours. Lectures and drawings. Heller's Notes and Johnson's Modern Framed Structures used for reference. Civil Engineering, fourth year, first term, *M., Tu., W., Th., F., at* 8. Prerequisite, Civil Engineering 7. Associate Professor MORRIS.

10. SANITARY ENGINEERING. Five credit hours. Recitations and lectures. Folwell's Sewerage. Civil Engineering, fourth year, third term, *M., Tu., W., Th., F., at* 9. Prerequisite, Civil Engineering 15. Professor ENO.

14. CIVIL ENGINEERING LABORATORY. Two credit hours. Civil Engineering, fourth year, second term, *M.,* 1 *to* 4; *Tu., at* 1, *or Tu.,* 1 *to* 4; *W., at* 1. Prerequisite, Civil Engineering 15. Professor ENO, Mr. WARD.

Cement testing and adjustment of instruments.

16. HIGHWAYS. Five credit hours. Recitations and lectures. Baker's Roads and Pavements. Civil Engineering, third year, first term, *M., T., W., Th., F., at* 8 *or* 9. Prerequisite, Civil Engineering 2. Professor ENO.

17. RAILWAY LOCATION. Five credit hours. Recitations and lectures. Wellington's Economic Theory of Railway Location. Option, Civil Engineering, fourth year, second term, *M., Tu., W., Th., F., at* 9. Prerequisite, Civil Engineering 15. Professor SHERMAN.

18. WATER SUPPLY. Five credit hours. Recitations and lectures. Turneaure and Russell's Public Water Supplies. Civil Engineering, fourth year, third term, *M., Tu., W., Th., F., at* 8. Prerequisite, Civil Engineering 15. Professor ENO.

19. TRUSSES. Five credit hours. Lectures and drawings. Architecture, Mining, and Mechanical Engineering, third year, third term, *M., Tu., Th., F., at* 10; *W., at* 2; *or M., Tu., W., Th., F., at* 11. Prerequisite, Mechanics 2. Associate Professor MORRIS.

21. SURVEYING. Three credit hours. Architecture and Industrial Arts, fourth year, third term, *M., W., F., at* 9. Prerequisite, Drawing 32 and Mathematics 14 or 32. Mr. CHAMBERLIN, Mr. WARD.

Recitations, lectures and field work.

22. SUMMER FIELD WORK. At conclusion of second year of course in Civil Engineering. Prerequisite, Civil Engineering 32 and 4. Professor SHERMAN, Professor ENO, Assistant Professor SCHLAFLY, Mr. CHAMBERLIN, Mr. WARD.

The students are taken into camp in a rough, broken country and given a thorough drill in elementary surveying. The course begins the Friday before Commencement Day, and continues four weeks of six days per week, ten hours per day. The work of the student and discipline of the camp is in the hands of competent instructors.

23. ADVANCED SUMMER FIELD WORK. Similar to 22. At conclusion of third year of Course in Civil Engineering. Prerequisite, Civil Engineering 3, 22, and 24.

24. TIMBER CONSTRUCTION. Five credit hours. Civil Engineering, third year, second term, *M., Tu., W.,* 1 *to* 5; *or W., Th., F.,* 1 *to* 5. Prerequisite, Drawing 35 and Mechanics 1. Assistant Professor SCHLAFLY, Mr. CHAMBERLIN.

25. ADVANCED BRIDGE WORK. Five credit hours. Draw-spans, continuous girders, steel arches, etc. Option, Civil Engineering,

fourth year, second term, *M., Tu., W., Th., F., at* 8. Prerequisite, Civil Engineering 8. Associate Professor MORRIS.

27. TIMBER AND MASONRY. Three credit hours. Industrial Arts and Mechanical Engineering, third year, last three-fifths of second term, *M., Tu., W., Th., F., at* 9. Concurrent, Industrial Arts 4 or Mechanics 2. Assistant Professor SCHLAFLY.

Lectures and recitations. Use of stone, brick, lime, cement, timber, etc., in engineering structures.

28. STEEL CONSTRUCTION. Five credit hours. Architecture, fourth year, second term, *M., Tu., W., Th., F., at* 9. Prerequisite, Civil Engineering 19. Associate Professor MORRIS.

Steel skeleton construction for tall buildings.

29. CEMENT TESTING. Three credit hours. Architecture, fourth year, second term, *Tu., W.,* 1 *to* 4. Prerequisite, Civil Engineering 15. Professor ENO, Mr. WARD.

30. SURVEYING. Five credit hours. Civil Engineering, second year, first term, *M., Tu., W., Th., F., at* 8 *or* 11. Prerequisite, Mathematics 14 or 32. Professors SHERMAN and ENO, Assistant Professor SCHLAFLY, Mr. CHAMBERLIN, Mr. WARD.

Recitations and lectures. Use and adjustment of instruments; farm, city, and hydrographic surveying, and leveling.

31. FIELD PRACTISE IN SURVEYING. One credit hour. Civil Engineering, second year, first term. Prerequisite, concurrent Civil Engineering 30.

32. RAILROAD SURVEYING. Five credit hours. Civil Engineering, second year, third term, *M., Tu., W., Th., F., at* 8 *or* 11. Prerequisite, Civil Engineering 30 and 31. Professors SHERMAN and ENO, Assistant Professor SCHLAFLY, Mr. CHAMBERLIN, Mr. WARD.

Simple and compound curves, spirals, frogs, and switches, and earthwork.

33. FIELD PRACTISE IN RAILROAD SURVEYING. One credit hour. Civil Engineering, second year, third term. Prerequisite, concurrent Civil Engineering 32.

34. MASONRY CONSTRUCTION. Three credit hours. Civil Engineering and Architecture, fourth year, first term, *M., W., F., at* 9. Prerequisite, Mechanics 2. Professor SHERMAN.

Recitations and lectures. Baker's Masonry Construction used as a text.

35. MASONRY STRUCTURES. Three credit hours. Civil Engineering, fourth year, second term, *M., Tu., Th., at* 10. Prerequisite, Civil Engineering 34. Professor SHERMAN.

Lectures and recitations, and drawing, designing of masonry structures. Baker's Masonry Construction, and various standard plans used for reference.

CLAY WORKING AND CERAMICS

(Office, School of Mines Building.)

PROFESSOR ORTON, ASSOCIATE PROFESSOR BLEININGER, MR. RIDDLE.

The equipment of the department is exceptional; it was provided by special act of the State Legislature, and has been extended by many valuable gifts and purchases. It is situated in the new School of Mines building, which has just been built and equipped at a cost of about $110,000. The floor space occupied by the Ceramic Department is about 14,000 square feet. The equipment comprises a chemical laboratory, a physical testing room, a stock and preparation room, a pottery laboratory, a machine room, chiefly devoted to grinding materials and manufacturing and testing structural materials, bricks, etc., a kiln room, two lecture rooms, a museum of ceramic materials and products, and library facilities unusually complete on the technical side.

The department is also much assisted by the co-operation of clay and cement manufacturers who have afforded opportunities for experimental work in their plants.

1. CERAMIC CHEMISTRY. Five credit hours. Ceramics and Short Clay-working, second year, first term. *M., Tu., W.,* 1 *to* 4. Prerequisite, Chemistry 12 or 45. Associate Professor BLEININGER.

Quantitative analysis of salts, lime stone and simple minerals.

2. Continuation of 1. Five credit hours. Ceramics and Short Clay-working, second year, second term. *M., Tu., W.,* 1 *to* 4. Associate Professor BLEININGER.

Quantitative analysis of clays and similar minerals; first, samples of known composition; later, unknown materials.

3. Continuation of 2. Five credit hours. Ceramics, second year, third term. *M., Tu., W.,* 1 *to* 4. Associate Professor BLEININGER.

Completion of the ultimate analysis of clays; the proximate or "Rational" analysis of clays and pottery bodies.

4. CLAY MANUFACTURE. Five credit hours. Ceramics, third

year, first term; Short Clay-working, second year, first term. *M., Tu., W., Th., F., at* 8. Concurrent, Ceramics 1. Professor ORTON.

The origin, composition, and properties of clays and other minerals employed in the clay, glass, and cement industries.

5. Continuation of 4. Five credit hours. Ceramics, third year; Short Clay-working, second year, second term. *M., Tu., W., Th., F., at* 8. Professor ORTON.

General principles of the manufacture of clay wares, including the selection and winning of the materials, their preparation, manufacture, and drying.

6. Continuation of 5. Five credit hours. Ceramics, third year; Short Clay-working, second year, third term. *M., Tu., W., Th., F., at* 8. Professor ORTON.

Burning and decoration of claywares, including the preparation of coloring materials, glazes, etc.

7. CERAMIC CHEMISTRY. Five credit hours. Ceramics, third year, third term. *M., Tu., W.,* 1 *to* 4. Prerequisite, Ceramics 3. Associate Professor BLEININGER.

The analysis of glasses and glazes, with special attention to the use of hydrofluoric acid in silicate analysis, and to the determination of the coloring oxides and boracic acid.

9. LABORATORY WORK IN CERAMICS. Five credit hours. Ceramics, fourth year, first term. *W., Th., F.,* 1 *to* 4. Prerequisite, Ceramics 3 and 6. Professor ORTON, Mr. RIDDLE.

Practise in clay testing and measurement of the physical properties of clays; the production of bodies made from single clays, from the blending of two or more natural clays, and from clays and minerals other than clays. In each case the bodies made are burnt and tested.

10. Continuation of 9. Five credit hours. Alternative with Ceramics 12. Ceramics, fourth year, second term. *W., Th., F.,* 1 *to* 4. Professor ORTON, Mr. RIDDLE.

The production of glasses and glazes, beginning with the soft raw-lead glazes, the fritted lead-boracic-acid glazes, and the hard-fire leadless porcelain glazes. In each case the glazes are made for use on some definite body.

11. Continuation of 10. Five credit hours. Alternative with Ceramics 18. Ceramics, fourth year, third term. *M., F.,* 8 *to* 12; *F.,* 1 *to* 3. Professor ORTON, Mr. RIDDLE.

Practise in the use of the coloring and opacifying oxides in glazes, and in the production of colors and body stains for the decoration of pottery.

12. CEMENT MANUFACTURE. Five credit hours. Alternative with Ceramics 10. Ceramics, fourth year, second term. *M., Tu., W., Th., F., at* 9. Prerequisite, Ceramics 3 and 6. Associate Professor BLEININGER.

The theory of hydraulicity, the compounding, manufacture, and testing of natural and Portland cements and hydraulic silicates.

15. THESIS.

18. CEMENT MANUFACTURE. Five credit hours. Laboratory. Alternative with Ceramics 11. Ceramics, fourth year, third term. *M., F.,* 8 *to* 12; *F.,* 1 *to* 3. Prerequisite, Ceramics 12. Associate Professor BLEININGER.

Training in the analysis of cement materials by the methods in technical use; in the preparation of minerals for cement; in the burning of cement; in the testing of the products, and in the investigation of the general problems of the cement manufacturer.

19. STOICHIOMETRY. Five credit hours. Short Clay-working, second year, third term. *M., Tu., W., Th., F., at* 11. Prerequisite, Ceramics 1 and 2. Associate Professor BLEININGER, Mr. RIDDLE.

Calculation of bodies and glazes and the combustion of the fuel necessary for work in driers and kilns.

20. LABORATORY WORK IN CERAMICS. Two credit hours. Short Clay-working, second year, first term. *Th., F.,* 1 *to* 4. Prerequisite, Chemistry 45. Concurrent, Ceramics 1. Professor ORTON, Mr. RIDDLE.

Testing of clays and minerals employed in clay manufacture.

21. LABORATORY WORK IN CERAMICS. Two credit hours. Short Clay-working, second year, second term. *Th., F.,* 1 *to* 4. Prerequisite, Ceramics 20. Professor ORTON, Mr. RIDDLE.

Compounding of artificial clay bodies and the blending of natural clays.

22. CERAMIC CHEMISTRY. Three credit hours. Ceramics, fourth year, second term. *M., Tu.,* 1 *to* 4. Prerequisite, Ceramics 6 and 7. Associate Professor BLEININGER.

The elementary conceptions of physical chemistry with special reference to the silicate industries.

23. LABORATORY WORK IN CERAMICS. Seven credit hours. Short Clay-working, second year, third term. *M., Tu., W., Th., F.,* 1 *to* 4. Prerequisite, Ceramics 2 and 5. Professor ORTON, Mr. RIDDLE.

The production of glazes of the types commonly used in the pottery and allied industries. Practise will be given in fitting glazes to some definite body.

DRAWING

(See Engineering Drawing.)

ECONOMICS AND SOCIOLOGY

(Office, Room 211, University Hall.)

PROFESSOR HAGERTY, PRESIDENT THOMPSON, ASSOCIATE PROFESSOR HAMMOND, ASSISTANT PROFESSOR MCKENZIE.

ECONOMICS

33. ELEMENTS OF POLITICAL ECONOMY. Three credit hours. Not open to first-year students. Industrial Arts, second year, three terms. *M., W., F., at* 8. Other Sections, *M., W., F.,* 9 *and* 11. Professor HAGERTY, Associate Professor HAMMOND.

A careful study of the laws of production, exchange, distribution, and consumption of wealth; combined with an analysis of the industrial actions of men as regards land, labor, capital, money, credit, rent, interest, wages, etc. Text-books, lectures, and individual investigations.

37. INDUSTRIAL ORGANIZATION AND MANAGEMENT. Three credit hours. Industrial Arts, fourth year, first term, *M., W., F., at* 9. Prerequisite, Economics 33. Associate Professor HAMMOND.

The various forms of business undertakings and the methods by which capital and labor are secured and organized for productive purposes are here considered. Especial attention is given to industrial corporations, their internal organization, securities, receiverships, and reorganization.

38. INDUSTRIAL CONCENTRATION AND MONOPOLY. Three credit hours. Industrial Arts, fourth year, second term. *M., W., F., at* 9. Prerequisite, Economics 37. Associate Professor HAMMOND.

A discussion of the forces and tendencies which lead to a large scale production. The causes and forms of industrial consolidations. Trust promotion, financiering, and management. The tendency toward monopoly and monopolistic methods. The relation of the state to the monopoly problem and proposed methods of public control of monopolies.

39. LABOR ORGANIZATIONS AND EMPLOYERS' ASSOCIATIONS. Three credit hours. Industrial Arts, fourth year, third term. *M., W., F., at* 9. Prerequisite, Economics 38. Associate Professor HAMMOND.

A study of methods by which laborers and employers organize for the purpose of endeavoring to control the labor market. The methods of collective bargaining, and the establishment of trade agreements.

48. ACCOUNTING AND STATISTICS. Two credit hours. Industrial Arts, third year, first, second, and third terms. *Tu., Th., at* 9.

57. AMERICAN INDUSTRIES. Three credit hours. Industrial Arts, second and third terms. *M., W., F., at* 2. Prerequisite, 33. Assistant Professor DUNCAN.

EDUCATION

(Office, University Hall, Room 407.)

PROFESSOR MAJOR, ASSISTANT PROFESSOR HAINES.

1. EDUCATIONAL PSYCHOLOGY. Three credit hours. Manual Training, second year, three terms. *M., W., F., at* 11. Professor MAJOR.

A study of laws and principles selected from psychological literature bearing on educational theory and practise. The function of psychology in determining the selection and arrangement of school studies, and its bearing on class room procedure. James' *Talks on Psychology,* supplemented by references to standard texts and to periodicals on psychology and education.

5. SCIENCE OF EDUCATION. Three credit hours. Manual Training, fourth year, three terms. *M. W., F., at* 11. Assistant Professor HAINES.

The foundations of educational theory; especially intended for the student who expects to deal with the larger problems of education which confront superintendent or principal. Lectures, required readings, and reports.

ELECTRICAL ENGINEERING

(Office, Electrical Building, Room 8.)

PROFESSOR CALDWELL, ASSOCIATE PROFESSOR ANDEREGG, ASSISTANT PROFESSOR COGGESHALL.

This department has excellent facilities for practical experimental work with dynamo machinery and other electrical apparatus. The equipment includes twenty-five dynamo machines of various makes and sizes from 40-H. P. down, aggregating over 250 horse-power, among them 110 and 500 volt direct and alternating current generators, railway and stationary motors, polyphase motors, and three rotary converters specially designed for experimental work. There are also a number of transformers of different makes, including one for welding, one for very high voltage and six of special design for testing. Arc lamps of different styles, a storage battery, condensers, inductance coils, resistances, circuit breakers and apparatus for magnetic testing, illumination testing and photometric work also form part of the equipment. The measuring instruments include about 75 voltmeters, ammeters, and wattmeters. The telephone laboratory has apparatus for comparative tests, a variety of transmitters and receivers, and material illustrative of switch-board practise. The calibration room is well equipped for standardization work.

Power is supplied from the University plant by five induction motors and two synchronous motors or converters. There is also a well-selected and growing collection of photographs, blue-prints and material, illustrative of electrical manufacture. The library is especially valuable on account of the completeness of its sets of periodicals and transactions. The University power plant is useful as illustrative of a model installation.

6. ELECTRICAL ENGINEERING. Two credit hours. Mechanical, Mine Engineering, Industrial Arts, and Manual Training, fourth year, first and second terms; Civil and Chemical Engineering, fourth year, first term. *M., Th., at* 10. Prerequisite, Physics 2. Associate Professor ANDEREGG.

Lectures on direct and alternating circuits, dynamo machinery, transformers, accumulators and their applications.

7. ELECTRICAL ENGINEERING. Two credit hours. Laboratory work on the subjects treated in 6. Fourth year. Associate Professor ANDEREGG, Assistant Professor COGGESHALL.

First Term

M., 1 *to* 5. Course in Chemical Engineering.
W., or F., 1 *to* 5. Course in Civil Engineering.
M., 1 *to* 5. Course in Industrial Arts.
M., 1 *to* 5. Course in Manual Training.
W., 1 *to* 5; *or S.,* 8 *to* 12. Course in Mechanical Engineering.

Second Term

M., 1 *to* 5. Course in Mine Engineering.
M., 1 *to* 5. Course in Industrial Arts.
M., 1 *to* 5. Course in Manual Training.

W., 1 *to* 5; *or S.*, 8 *to* 12. Course in Mechanical Engineering. *M.*, 1 *to* 5. Course in Mine Engineering.

8. DIRECT CURRENT DYNAMO MACHINERY. Four credit hours. Electrical Engineering, third year, second term. *M., Tu., Th., F., at* 9. Prerequisite, Physics 4. Mechanics 1. Concurrent, Physics 6. Associate Professor ANDEREGG.

Generators and motors, their theory, construction, and operation. Lectures, recitations and problems.

9. ELEMENTARY DYNAMO LABORATORY. Four credit hours. Electrical Engineering, third year, third term. *W., Th.*, 1 *to* 5; *or F.*, 1 *to* 5; *S.*, 8 *to* 12. Prerequisite, Electrical Engineering 8. Associate Professor ANDEREGG, Assistant Professor COGGESHALL.

Handling and testing of circuits, generators, motors, etc.

11. ADVANCED DYNAMO LABORATORY. Three credit hours. Electrical Engineering, fourth year, first and second terms, *Tu., or Th.*, 10 *to* 5; third term, *M., or Tu.*, 10 *to* 5. Prerequisite, Electrical Engineering 15. Concurrent, 16 and 17. Professor CALDWELL, Assistant Professor COGGESHALL.

Alternating current, railway and telephone apparatus, accumulators, illumination, etc.

15. ALTERNATING CURRENT CIRCUITS AND MACHINERY. Two credit hours. Electrical Engineering, third year, third term. *M., Th., at* 10. Concurrent, Electrical Engineering 9. Professor CALDWELL.

Systems, generators, and transformers.

16. Continuation of 15. Three credit hours. Electrical Engineering, fourth year, first term. *M., W., F., at* 11. Concurrent, Electrical Engineering 11. Professor CALDWELL.

Synchronous and induction motors. etc.

17. Continuation of 16. Two credit hours. Electrical Engineering, fourth year, second term. *M., W., at* 8. Concurrent, Electrical Engineering 11. Professor CALDWELL.

18. ELECTRICAL DESIGN. Three credit hours. Electrical Engineering, fourth year, second term. *F.*, 1 *to* 4; *S.*, 8 *to* 11. Prerequisite, Drawing 5. Concurrent, Industrial Arts 9. Assistant Professor COGGESHALL.

Direct and alternating current generators, transformers.

19. Continuation of 18. Four credit hours. Electrical Engineering, fourth year, third term. *W., Th.*, 1 *to* 5. Assistant Professor COGGESHALL.

20. INSPECTION TRIP TO THE EAST. Given only in the even years. Electrical Engineering, third or fourth year.

Includes Pittsburg, Buffalo, Niagara, Cleveland, and possibly other places; is taken at the end of the winter term and occupies six days. The entire expense need not exceed $30.00. A satisfactory written report upon the work of the trip is required.

21. INSPECTION TRIP TO THE WEST. Given only in the odd years. Electrical Engineering, fourth or third year.

Includes Chicago, Milwaukee, Cincinnati, and possibly other places; is taken at the end of the winter term, and occupies six days. The entire expense need not exceed $30.00. A satisfactory written report on the work of the trip is required.

22. READING COURSE. Electrical Engineering, third or fourth year; this may be taken as a substitute for 20, on presentation of reasons satisfactory to the head of the department.

Course of assigned reading upon processes of manufacture and power plants.

23. Similar to 22. A substitute for 21.

24. APPLICATIONS OF ELECTRICITY. Two credit hours. Electrical Engineering, fourth year, second term. *Tu., Th., at* 8. Prerequisite, Electrical Engineering 8. Professor CALDWELL, Associate Professor ANDEREGG.

Brief treatment of the elements of illumination, railway work, telephone, storage batteries, mining, etc.

25. ELECTRICAL TRANSMISSION AND DISTRIBUTION Two credit hours. Electrical Engineering, fourth year, third term. *Tu., Th., at* 8. Prerequisite, Electrical Engineering 8. Professor CALDWELL.

Systems, apparatus. and operation.

26. ELECTRICAL RAILWAYS. Three credit hours. Electrical Engineering, fourth year, third term. *M., W., F., at* 8. Alternative with courses 27 and 28. Prerequisites, Electrical Engineering 17 and 24. Professor CALDWELL.

Including principles of general design, transmission and distribution systems, cars, motors, and operation.

27. TELEPHONY. Three credit hours. Electrical Engineering, fourth year, third term. *M., W,, F., at* 9. Alternative with courses 25 and 28. Prerequisite, Electrical Engineering 17 and 24. Associate Professor ANDERBEGG.

Methods of operation. Simple circuits and apparatus. Elements of transmission theory.

28. ELECTRIC ILLUMINATION. Three credit hours. Electrical Engineering, fourth year, third term. *Tu., Th., at* 9; *F., at* 10. Alternative with 26 and 27. Prerequisite, Electrical Engineering 17 and 24. Professor CALDWELL.

ENGINEERING DRAWING.

(Office, Brown Hall, Room 42.)

PROFESSOR FRENCH, ASSISTANT PROFESSOR LEWIS, ASSISTANT PROFESSOR MAJOR, MR. TIDBALL, MR. ROGERS, MR. MEIKLEJOHN, MR. NORRIS.

The Mechanical Drawing and Photography are taught in Brown Hall. For the Mechanical Drawing there are four large, well-lighted drafting rooms with necessary tables and lockers, and two lecture rooms equipped with electric projection lantern. A set of Schroeder models and a collection of shop drawings are available. There are two blue-print rooms, one provided with an Elliott electric light printing machine, the other with sun frames. For Photography there is an especially built dark room with forty-three developing compartments; also two laboratories equipped with toning and mounting tables; printing apparatus, copying cameras, lenses of long and short focus, tele-photographic lens, color screens, shutters, and an excellent outfit for photo-micrography.

The Freehand Drawing, Painting, and Modeling are carried on in Hayes Hall. The rooms are equipped with the usual tables, models and casts, easels, modeling tools, and other needed apparatus.

2. LETTERING. Practise and occasional lectures. Three credit hours. Short Clay-working and Industrial Arts, first year; Short Mining, second year, first term, *Th., F., 1 to 4.* Concurrent, Drawing 24 or 27. Mr. ROGERS.

5. TECHNICAL DRAWING. Three credit hours. Electrical and Mechanical Engineering, Industrial Arts and Manual Training, third year, first term, *M., Tu., 1 to 4, or Th., F., 1 to 4.* Prerequisite, Drawing 35. Professor FRENCH, Assistant Professor MAJOR.

Rules and methods for making working drawings in machine design to represent correctly form and dimensions for shop use, and for tracing and blue-printing the same.

7. PHOTOGRAPHY. Two credit hours. Architecture, third year; Ceramics, fourth year, first term, *M., Tu., 1 to 3.* Civil and Mechanical Engineering, third year; Mining Engineering, fourth year, third term, *M., Tu., 1 to 3, or Th., F., 1 to 3.* Prerequisite,

Chemistry 7, and Physics 2. Professor BRADFORD, Assistant Professor LEWIS.

Lectures. Optics of photography, chemistry of photography, exposing and developing, printing lantern slides, orthochromatic photography, and some of the applications of photography. Practise: Outdoor. interior, and instantaneous photography, copying, lantern slides, and printing.

14. PEN DRAWING. Two credit hours. Architecture, second year, first term, *M., Tu.,* 1 *to* 3. Prerequisite, Drawing 26. Mr. NORRIS.

18. WATER COLOR PAINTING. Two credit hours. Architecture, third year, second term, *Tu., Th.,* 9 *to* 11. Prerequisite, Drawing 26. Mr. NORRIS.

19. WATER COLOR PAINTING. Three credit hours. Architecture, third year, third term, *Tu., Th.,* 8 *to* 10; *M.,* 1 *to* 3. Prerequisite, Drawing 18. Mr. NORRIS.

21. TECHNICAL DRAWING. Two credit hours. Chemical Engineering, third year, first term, *W., F.,* 8 *to* 10. Assistant Professor MAJOR.

22. TECHNICAL DRAWING. Two credit hours. Chemical Engineering, third year; Ceramics, fourth year, second term, *S.,* 8 *to* 12. Prerequisite, Drawing 21 or 39. Professor FRENCH.

23. TECHNICAL DRAWING. Two credit hours. Chemical Engineering, third year; Ceramics, fourth year, third term, *S.,* 8 *to* 12. Prerequisite, Drawing 22. Professor FRENCH.

24. FREE HAND DRAWING. One credit hour. Short Industrial Arts, first year, first term, *W.,* 1 *to* 3. Mr. TIDBALL.

Pencil drawing from models and plaster casts. Practise and occasional lectures.

25. FREE HAND DRAWING. One credit hour. Short Industrial Arts, first year, second term, *W.,* 1 *to* 3. All four-year courses, first year, second term. Prerequisite, Drawing 24 or 27. Assistant Professor LEWIS, Mr. TIDBALL, Mr. MORRIS.

Brush work from models and plaster casts. Practise and occasional lectures.

26. FREE HAND DRAWING. One credit hour. Short Industrial Arts, first year, third term, *W.,* 1 *to* 3. All four-year courses, first year, third term. Prerequisite, Drawing 25. Assistant Professor LEWIS, Mr. TIDBALL, Mr. NORRIS.

Brush work from plaster casts and still-life. Practise and occasional lectures.

27. FREE HAND DRAWING. Two credit hours. Short Mining, second year, first term, *W., F.,* 8 *to* 10. All four-year courses, first

year, first term. Assistant Professor LEWIS, Mr. TIDBALL, Mr. NORRIS.

Pencil drawing from models and plaster casts. Practise and occasional lectures.

31. GEOMETRIC DRAWING. One credit hour. Practise in the use of drawing instruments. All four-year courses, first year, second term. Professor FRENCH, Assistant Professor MAJOR, Mr. ROGERS, Mr. MEIKLEJOHN.

32. LETTERING. Two credit hours. Practise and occasional lectures. All four-year courses, first year, third term. Prerequisite, Drawing 31. Professor FRENCH, Assistant Professor MAJOR, Mr. ROGERS, Mr. MEIKLEJOHN.

33. PROJECTION DRAWING. Three credit hours. Second year, first term. Prerequisite, Drawing 2 or 32. Professor FRENCH. Assistant Professor MAJOR, Mr. ROGERS, Mr. MEIKLEJOHN.

Lectures.	Practise.	Course in
M., at 10	*Tu., Th.,* 9 *to* 11	Architecture.
W., at 11	*M., F.,* 10 *to* 12	Ceramics.
W., at 11	*M., F.,* 10 *to* 12	Chemical Engineering.
M., at 10	*Tu., Th.,* 9 *to* 11	Civil Engineering.
Tu., at 11	*M., F.,* 10 *to* 12	Electrical Engineering.
W., at 11	*M., F.,* 10 *to* 12	Industrial Arts.
M., at 10	*M., F.,* 10 *to* 12	Manual Training.
W., at 10	*M., F.,* 10 *to* 12	Mechanical Engineering.
W., at 11	*Tu., Th.,* 9 *to* 11	Mine Engineering.

Lectures and practise. Orthographic, isometric, and oblique projections, and elementary working drawings.

34. DESCRIPTIVE GEOMETRY. Three credit hours. Lectures and practise. Second year, second term.

Lectures.	Practise.	Course in
M., W., at 11	*F.,* 10 *to* 12	Ceramics.
M., W., at 11	*F.,* 10 *to* 12	Chemical Engineering.
Tu., Th., at 11	*F.,* 10 *to* 12	Electrical Engineering.
M., W., at 11	*F.,* 10 *to* 12	Industrial Arts.
M., W., at 8	*F.,* 10 *to* 12	Manual Training.
M., W., at 11	*F.,* 10 *to* 12	Mechanical Engineering.
M., W., at 11	*Tu.,* 9 *to* 11	Mine Engineering.
M., W., at 8	*Th.,* 9 *to* 11	Short Industrial Arts.

Prerequisite, Drawing 33 or 38. Professor FRENCH, Assistant Professor MAJOR, Mr. ROGERS, Mr. MEIKLEJOHN.

35. SHADES, SHADOWS, AND PERSPECTIVE. Three credit hours, second year, third term.

Lectures.	Practise.	Course in
M., at 10	*Tu., Th.,* 9 *to* 11	Civil Engineering.
W., at 11	*M., F.,* 10 *to* 12	Electrical Engineering.
W., at 11	*M., F.,* 10 *to* 12	Industrial Arts.
M., at 8	*M., F.,* 10 *to* 12	Manual Training.
M., at 11	*M., F.,* 10 *to* 12	Mechanical Engineering.
Tu., at 11	*Tu., Th.,* 9 *to* 11	Mine Engineering.
M., at 10	*Tu., Th.,* 9 *to* 11	Short Industrial Arts.

Prerequisite, Drawing 34 or 36. Professor FRENCH, Assistant Professor MAJOR, Mr. ROGERS, Mr. MEIKLEJOHN.

36. DESCRIPTIVE GEOMETRY. Five credit hours. Architecture and Civil Engineering, second year, second term, *M,, W., at* 8; *Tu., Th.,* 8 *to* 11, *or M., W., at* 11; *Tu., Th.,* 9 *to* 12. Prerequisite, Drawing 33 or 38. Professor FRENCH, Assistant Professor MAJOR, Mr. ROGERS, Mr. MEIKLEJOHN.

38. PROJECTION DRAWING. Three credit hours. Lectures and practise. Orthographic, isometric and oblique projections and intersections. Short Clay-working and Industrial Arts, first year; Short Mining, second year, second term., *Th.,* 1 *to* 4; *F.,* 1 *to* 3. Prerequisite, Drawing 2 or 32. Mr. ROGERS.

39. DRAFTING AND BLUE-PRINTING. Three credit hours. Short Clay-working and Industrial Arts, first year; Short Mining and Ceramics, second year, third term, *Th., F.,* 1 *to* 4. Prerequisite, Drawing 33 or 38. Mr. ROGERS.

40. CLAY MODELING. Two credit hours. Architecture, third year, second term, *M., Tu.,* 1 *to* 3, *or Tu.,* 1 *to* 5. Prerequisite, Drawing 26. Assistant Professor LEWIS.

Modeling in clay, ornamental forms from plaster casts, photographs and nature.

41. CLAY MODELING. Two credit hours. Architecture, third year, third term, *M., Tu.,* 1 *to* 3, *or Tu.,* 1 *to* 5. Prerequisite, Drawing 40. Assistant Professor LEWIS.

Modeling in clay and wax from photographs, nature, and original designs. Casts made in plaster and gelatine molds.

ENGLISH

(Office, University Hall, Room 116.)

PROFESSOR DENNEY, ASSISTANT PROFESSORS GRAVES, MCKNIGHT, DUNCAN, MR. MCKINNEY, MR. PARKER.

1. PARAGRAPH WRITING AND ANALYSIS OF PROSE. Two credit hours. All four-year courses, first year, first, second and third terms, *Tu., Th., at* 8; *W., F., at* 8; *or Tu., Th., at* 9, 10, or 1.

Writing of short themes, outlining and composition of essays and speeches and the study of illustrative texts for structure and form.

3. BRIEF-MAKING AND WRITTEN ARGUMENTATION. Two credit hours. Industrial Arts, Manual Training, and Electrical and Mechanical Engineering, second year; Architecture, Ceramics, and Chemical, Civil and Mine Engineering, third year. First, second, and third terms, *M., F., at* 10, *or Tu., Th., at* 10, *or Tu., Th., at* 11, *or W., F., at* 1. Prerequisite, English 1.

Principles of logical analysis, evidence and argumentation, writing briefs of noted speeches, preparation of original briefs with written argumentation.

FRENCH

(See Romance Languages and Literatures.)

GEOLOGY

(Office, Orton Hall, Room 1.)

PROFESSOR PROSSER, PROFESSOR BOWNOCKER, ASSISTANT PROFESSOR HUBBARD.

By an act of the Legislature, the University has been put in possession of all the collections made by the geological survey, and these have been supplemented by valuable additions of fossils and minerals from various sources. The State collection embraces a very complete representation of every geological formation shown in Ohio. Exceptionally good opportunities exist for work in the lithological, stratigraphical, and physiographical laboratories.

Orton Hall is designed for the permanent accommodation of these large geological collections and for work and instruction in the department of Geology. The building is built of brick and faced with sandstone. Some of the material was contributed by various quarries of the State of Ohio, and almost all of the finer varieties of Ohio building stone are represented in the columns, walls, and ceiling panels of the vestibule.

1. Physiography. Five credit hours. One period per week will be devoted to laboratory or field work. Short Mining, first year; Short Industrial Arts, second year, third term, *M., Tu., W., Th., F., at* 11. Assistant Professor Hubbard.

The topographic features of the earth's surface and the agencies producing these. The atmosphere, climate, etc. Oceans, rivers, and lakes. Recitations, lectures, map work.

2. General Geology. Five credit hours. Architecture, Ceramics, Civil, and Mine Engineering, fourth year, first term. Lectures and recitations, *M., Tu., W., F., at* 11; Laboratory, *Th.;* field work first half of term, *F.* afternoon or *S.* forenoon, when the *F.* lecture will be omitted. Professor Prosser, Assistant Professor Hubbard.

Structural, dynamical and historical geology. The lectures are illustrated by maps, specimens and lantern views. The common rock-forming minerals, and rocks are studied in the laboratory; while in the field specimens are collected, sections measured, formations identified, and the student given an idea of the method of work pursued by a field geologist.

4. Elementary Geology. Five credit hours. Short Mining, second year, second term, *M., Tu., W., Th., F., at* 9. Assistant Professor Hubbard.

Lithological, dynamical, structural, and historical geology. Recitations, lectures, laboratory work.

6. Economic Geology. Three credit hours. Ceramics, Civil, and Mine Engineering, fourth year, second term, *M., W., F., at* 11. Prerequisite, Geology 2. Professor Bownocker.

The nature of ores, their classification, and origin. The metals of the United States, their distribution, abundance, modes of occurrence, and origin. The non-metals, coal, oil, gas, clay, lime, cement, building stone, etc. In the discussion of the non-metals emphasis will be laid on the products of Ohio.

7. Petrography. Two credit hours. Ceramics and Mine Engineering, fourth year, second term, *Tu.,* 10 *to* 12; *F., at* 10. Concurrent, Geology 6. Professor Bownocker.

The igneous, sedimentary, and metamorphic rocks—their origin and classification. The object of this course is to give the student a practical acquaintance with rocks..

GERMANIC LANGUAGES AND LITERATURES

(Office, University Hall, Room 317.)

PROFESSOR RHOADES, ASSOCIATE PROFESSOR VILES, ASSISTANT PROFESSOR EISENLOHR.

1. ELEMENTARY GERMAN. Four credit hours. First, second, and third terms. *M., Tu., Th., F., at* 10 *or* 11, *or Tu., W., Th., F., at* 2 *or* 3.

Required of all students who offer partial credit in German as their entrance language. Offered as alternative with French 1 and Spanish 1 to all students who enter with full or partial credit in Latin or Greek, or without previous language training.

2. SCIENCE READING. Four credit hours. Required of all students who offer only German as their modern language for entrance. Third term, *M., Tu., W., Th., at* 8 *or* 9. Prerequisite, German 4.

4. INTERMEDIATE GERMAN. Four credit hours. First and second terms, *M., Tu., Th., F., at* 10 *or* 11; *Tu., W., Th., F., at* 8, 9 *or* 2. Prerequisite, German 1.

Review of Grammar. Reading of descriptive and narrative prose, with prose composition. Required of all students who offer only German as their modern language for entrance.

HISTORY

(See American History and Political Science.)

INDUSTRIAL ARTS

(Office, Hayes Hall, Room 2.)

PROFESSOR SANBORN, ASSISTANT PROFESSOR KNIGHT, MR. RENCK, AND MR. CROWE.

The shops in Hayes Hall afford excellent facilities for instruction in both the practical details and the underlying principles of carpentry, pattern-making, forging, molding, founding, and machine work.

The carpenter and pattern shop contains twenty-five benches with complete sets of carpenter tools, twenty-three turning lathes, eight-foot pattern-maker's lathe with compound rest, pony planer, buzz planer, circular saw, scroll saw, 36-inch band saw, trimmer and power grindstone.

The forge shop has twenty stationary forges, with anvils and tools, heating furnace, four blacksmith's vises, foot-power hammer, blacksmith's drill and a punch, shear and bar cutter. The blast and exhaust fans are driven by an electric motor.

The foundry has a 24-inch Colliau cupola; two brass furnaces, core oven, space for floor molding 30 feet by 40 feet, and the necessary molding tools, flasks, crucibles, ladles, tongs, etc.

The machine shop is driven by an electric motor from above, and is equipped with twenty-eight benches for vise work with complete sets of tools, eight speed lathes, sixteen engine lathes, Fox monitor turret lathe, two planers, two shapers, two milling machines, two upright drills, sensitive drill, grinding machine, tool grinders, emery wheels, etc. The tool-room contains full sets of drills, taps, dies, milling cutters, standard plugs, gauges, threads, micrometers, and a great variety of special tools.

INDUSTRIAL ARTS

1. TOOLS AND MACHINES. Three credit hours. Industrial Arts and Manual Training, third year; Short Industrial Arts, second year, first, second, and third terms, *Tu., Th., S., at* 8. Prerequisite, Mathematics 14 or 32. Concurrent, Physics 1. Professor SANBORN.

Principles underlying the construction and operation of machine tools, and materials used in construction.

2. DESIGNING. Three credit hours. Industrial Arts and Manual Training, third year; Short Industrial Arts, second year, second and third terms, *F.,* 1 *to* 4; *S.,* 9 *to* 12. Professor SANBORN.

Problems in design, to accompany 1.

3. SHOP EQUIPMENT, APPLIANCES AND MANAGEMENT. Three credit hours. Industrial Arts, fourth year, first, second, and third terms, *M., W., F., at* 11. Prerequisite, Industrial Arts 1. Concurrent, Industrial Arts 4. Professor SANBORN.

Strength and durability of the materials used in construction; shop and factory buildings and their construction; power, power transmission and prime movers; methods of compensation, and shop accounts and management.

4. ADVANCED DESIGNING. Three credit hours. Industrial Arts, fourth year, first and second terms, *M., Tu.,* 1 *to* 4; Third term, *W., Th.,* 1 *to* 4. Prerequisite, Drawing 5. Concurrent, Industrial Arts 3. Professor SANBORN.

Graphical problems in construction. Design of buildings and the arrangement of machinery, line-shafting, etc., for manufacturing plants.

5. WORKSHOP APPLIANCES. Three credit hours. Mechanical Engineering, fourth year, third term, *M., W., F., at* 8. Prerequisite, Civil Engineering 19. Professor SANBORN.

Lectures and problems on the construction of shop buildings and the arrangement of machinery; special shop appliances.

8. MACHINE DRAWING. Three credit hours. Short Industrial Arts, second year, first term, *Th., F.,* 1 *to* 4. Prerequisite, Drawing 39. Professor SANBORN.

Working sketches of mechanisms and machines from measurement; detail and assembly drawings of same.

9. MACHINE DESIGN. Two credit hours. Electrical Engineering, fourth year, second term, *M., W.,* 1 *to* 3. Prerequisite, Mechanics 2 and Drawing 5. Professor SANBORN.

Practical application of the principles of machine design.

SHOPWORK

NOTE.—For time requirements, credit given, and all similar information concerning shopwork courses, see table page 81.

3. FOUNDRY WORK. Mr. RENCK.

Exercises and practise in tempering sand and preparing moulds of machine parts in the sand, core-making, melting iron and brass and pouring castings.

4. CHIPPING AND FILING. Assistant Professor KNIGHT.

Exercises and practise in vise work, including chipping in cast and wrought iron, surface filing, squaring, fitting, finishing, and the scraping of surface plates.

7. CARPENTRY AND PATTERN MAKING. Mr. RENCK.

Exercises and practise in carpentry, wood-turning and pattern-making, including sawing, planing, mortising, framing, and other work, involving the use of the ordinary carpenter tools; center and chuck turning, the making of finished patterns; and enough elementary moulding to illustrate draft, parting, cores, etc.

8. CABINET WORK. Prerequisite, Shop 7. Mr. RENCK.

Exercise and practise in cabinet making, including paneling, mitre and dovetail joints, etc.; use of power tools.

9. ADVANCED PATTERN MAKING. Continuation of pattern work of Shopwork 7. Mr. RENCK.

11. FORGING. Mr. CROWE.

The use and care of forge, fire, and tools; practise in iron and steel forging, including such operations as cutting, bending, drawing, upsetting, shaping and welding iron; the making, hardening and tempering of steel punches, chisel and lathe tools.

12. ADVANCED FORGING. Prerequisite, Shop 11. Mr. CROWE.

Various forms of welds in iron and steel; the use of scrolling irons and of forms for duplicating work; annealing; tool making; case-hardening; tempering drills, dies and cutters; spring making; ornamental iron work; visits to shops.

13. MACHINE WORK. Assistant Professor KNIGHT.

Exercises and practise in hand-turning in iron and brass on speed lathes; in straight and taper turning, boring, fitting, chucking, and thread-cutting on engine lathes.

14. MACHINE WORK. Prerequisite, Shop 13. Assistant Professor KNIGHT.

Exercises and practise on the lathe, planer, shaper, drill press, and milling machine, with use of small tools as drills, taps, dies, reamers, counterborers, etc.; construction of parts of actual machines.

15. ADVANCED MACHINE WORK. Prerequisite, Shop 14. Assistant Professor KNIGHT.

Exercises and practise on turret lathe, universal, surface and tool grinding machines; in gear-cutting, etc.

16. ADVANCED MACHINE WORK. Prerequisite, Shop 15. Assistant Professor KNIGHT.

The construction and use of jigs and templates; the accurate laying out of work; the duplication of parts, the production of work rapidly and economically, etc.

17. ADVANCED MACHINE WORK. Prerequisites, Industrial Arts 3 and Shop 16. Assistant Professor KNIGHT.

The making and use of special tools and fixtures, standard plugs and collars, standard caliper and limit gauges; error limits in modern machine construction; methods of testing the accuracy of machine tools, etc.

SUMMER TERM. The Summer Term in Shopwork will begin on Monday morning preceding Commencement Day and continue for four weeks. The courses open to students are Shopwork 4, 7, 11, 13, 14, and 15, three credit hours in each. Each course requires three hours a day for six days a week.

Students electing the Ceramics or the Electrical or Mechanical Engineering Course are required to take two of the three courses, Shopwork 4, 7, and 11 at the close of their first year.

Students electing the Chemical Engineering Course are required to take Shopwork courses 7 and 11 at the close of their first or second year.

Students in the Short Course in Clay-working are required to take Shopwork 7 and 11 at the close of their first year.

The courses are open as elective to students who desire to lighten their work of the regular terms, to make up back work or to take extra work.

SHOPWORK REQUIRED

Number	Credit hours	Subject	Year	Term	Hours	Courses in
3	2	Founding	2	1	M. 3, Tu. 1-4; W. 3, Th. 1-4; or S. 8-12	Mech. Eng.
3	2	Founding	2	1	M. 3, Tu. 1-4	Short Ind. Arts.
3	3	Founding	2	1	M. 1-4; Tu. 1-4	Ind. Arts; Man. Tr.
3	2	Founding	. .	2	M. 3, Tu. 1-4	....
4	3	Chipping and Filing	2	1	W. 1-4; S. 9-12	Short Ind. Arts.
4	3	Chipping and Filing	. .	. .	See Courses)	El.Eng.; Mech.Eng.
4	3	Chipping and Filing	3	1	M. Tu. 1-4	Ind. Arts.
4	3	Chipping and Filing	3	1	M. Tu. 9-12	Manual Train.
7	2	Woodworking	2	1	M. F. 10-12	Mining Eng.
7	3	Woodworking	1	1	M. Tu. 1-4	Short Ind. Arts.
7	3	Woodworking	2	1	Th. F. 1-4	Manual Train.
7	3	Woodworking	2	1	Th. F. 1-4	Ind. Arts.
7	3	Woodworking	. .	. .	(See Courses)	Chem., El.& Mec. E.
8	3	Cabinet Work	2	3	M. Tu. 1-4	Ind. Arts; Man. Tr.
9	3	Adv. Pattern Work.	2	1	Tu. Th. 9-12; or Th. F. 1-4	Mech. Eng.
9	3	Adv. Pattern Work.	1	2	M. Tu. 1-4	Short Ind. Arts.
9	3	Adv. Pattern Work.	2	2	M. Tu. 1-4	Ind. Arts; Man. Tr.
9	3	Adv. Pattern Work.	. .	. .	(See Courses)	Mech. Eng.
11	3	Forging	. .	. .	(See Courses)	Chem., El.& Mec. E.
11	2	Forging	2	2	Th. F. 10-12	Mining Eng.
11	3	Forging	2	2	Th. F. 1-4	Ind. Arts; Man. Tr.
11	3	Forging	1	3	M. Tu. 1-4	Short Ind. Arts.
11	3	Forging	1	3	M. Tu. 1-4	Short Mining.
12	3	Adv. Forging	2	3	Th. F. 1-4	Ind. Arts; Man. Tr.
13	3	Machine Work	2	2	M. Tu. 1-4; or W. Th. 1-4; or F. 1-4, S. 8-11	Elec. Eng.
13	3	Machine Work	3	2	M. Tu. 9-12	Man. Train.
13	3	Machine Work	3	2	M. Tu. 1-4	Ind. Arts.
13	3	Machine Work	2	2	W. Th. 1-4	Short Ind. Arts.
13	3	Machine Work	2	3	M. Tu. 1-4; or F. 1-4, S. 8-11	Mech. Eng.
14	3	Adv. Machine Work	3	1	M. Tu. W. 8-10; or Th. F. S. 8-10.	Elec. Eng.
14	3	Adv. Machine Work	3	1	M. Tu. Th. 10-12; or M. Tu. 1-4	Mech. Eng.
14	3	Adv. Machine Work	2	3	W. Th. 1-4	Short Ind. Arts.
14	3	Adv. Machine Work	3	3	M. F. 9-12	Man. Train.
14	3	Adv. Machine Work	3	3	M. Tu. 1-4	Ind. Arts.
15	3	Adv. Machine Work	4	1	F. 1-4; S. 8-11	Ind. Arts; Man. Tr.
15	4	Adv. Machine Work	3	2	M. Tu. Th. F. 10-12; or F. 1-5, S. 8-12	Mech. Eng.
16	3	Adv. Machine Work	4	2	M. W. F. 8-10	Ind. Arts; Man. Tr.
17	3	Adv. Machine Work	4	3	M. Tu. 1-4	Ind. Arts.

MATHEMATICS

(Office, University Hall, Room 314.)

PROFESSOR BOHANNAN, ASSOCIATE PROFESSOR MCCOARD, ASSOCIATE PROFESSOR SWARTZEL, ASSISTANT PROFESSOR ARNOLD, ASSISTANT PROFESSOR KUHN, ASSISTANT PROFESSOR RASOR, AS-ASSISTANT PROFESSOR PRESTON, MR. COX, MISS BAREIS.

2. ELEMENTARY ALGEBRA. Five credit hours. Text-book: Wentworth's Algebra. Short Clay-working, Industrial Arts, and Mining, first year, first, second, and third terms, *M., Tu., W., Th., F., at* 9.

3. PLANE GEOMETRY. Five credit hours. Text-book: Venable's Geometry. Short Clay-working, Industrial Arts, and Mining, first year, first term, *M., Tu., W., Th., F., at* 11.

11. DIFFERENTIAL EQUATIONS. One credit hour. Text-book: Boyd's Differential Equations. Mechanical Engineering, third year, first term, *F., at* 10. Prerequisite, Mathematics 43.

13. SOLID GEOMETRY. Five credit hours. Text-book: Venable's Geometry. Short Clay-working, Industrial Arts, and Mining, first year, second term, *M., Tu., W., Th., F., at* 11. Prerequisite, Mathematics 3.

14. PLANE TRIGONOMETRY. Five credit hours. Text-book: Bohannan's Trigonometry. Short Clay-working, Industrial Arts, and Mining, first year, third term, *M., Tu., W., Th., F., at* 8.

31. COLLEGE ALGEBRA. Five credit hours. Text-book: Hawkes' College Algebra. All four-year courses, first year, first term, *M., Tu., W., Th., F., at* 8, 9, 11, 1 *or* 2.

This course is repeated in the second term for the benefit of students who fail in it in the first term.

32. TRIGONOMETRY. Five credit hours. Text-book: Bohannan's Trigonometry. All four-year courses, first year, second term, *M., Tu., W., Th., F., at* 8, 9, 11, 1, *or* 2.

This course is repeated in the third term for the benefit of students who fail in it the second term.

33. ANALYTICAL GEOMETRY. Five credit hours. Text-book: Ashton's Analytical Geometry. All four-year courses, first year, third term, *M., Tu., W., Th., F., at* 8, 9, 11, 1 *or* 2. Prerequisite, Mathematics 32.

This course is repeated in the Summer Term.

41. CALCULUS. Five credit hours. Text-book: Osborne's Calculus. Second year, first term. Prerequisite, Mathematics 33.

M., Tu., W., Th., F., 1—Course in Architecture.
" 8—Course in Ceramics.
" 8—Course in Chemical Engineering.
" 8 or 11—Course in Civil Engineering.
" 8—Course in Electrical Engineering.
" 8 or 9—Course in Mechanical Engineering.
" 8—Course in Mine Engineering.

42. CALCULUS. Five credit hours. Text-book: Granville's Calculus. Second year, second term. For hours and courses see Course 41. Prerequisite, Mathematics 41.

43. CALCULUS. Five credit hours. Text-book: Osborne's Calculus. Second year, third term. For hours and courses see Course 41. Prerequisite, Mathematics 41.

74. DIFFERENTIAL EQUATIONS. Three credit hours. Second term. Elective. Prerequisite, Mathematics 43. Text-book: Boyd's Differential Equations.

25. HIGHER MATHEMATICS. Elective.

MECHANICAL ENGINEERING

(Office, Hayes Hall, Room 11.)

PROFESSOR MAGRUDER, PROFESSOR HITCHCOCK, ASSISTANT PROFESSOR JUDD, ASSISTANT PROFESSOR KING, MR. STRAUB, MR. WILCOX.

The lectures and recitations of this department are at present held in Hayes Hall, and the laboratory work in Mechanical Hall. The technical museum in Hayes Hall contains samples of engineering supplies and materials and a collection of models of mechanism and valve gears.

The laboratory portion of the new Engineering Building for the department is now in process of erection, and will be completed probably during the year 1907-08.

The present laboratories are arranged to carry on experiments and investigations along the following general lines: Strength of materials in compression, tension, torsion, cross breaking and shearing; gas, hot air, and steam engines, under varied conditions of running; hydraulics, including pumps and water-wheels; pneumatics, including air-brakes, compressors, fans, and ventilating systems; power transmission, including belts, pulleys, and oils; boiler testing; calibration of instruments.

Some of the principal machines for the above work are Olsen and Riehle testing machines; four gas and oil engines; Ericsson and Rider hot-air engines; three 35-horse power horizontal and one vertical, simple and compound steam engines with condensers; simple, compound, triplex, centrifugal and rotary pumps, pulsometer, turbine and impulse wheels, tanks, weirs, meters, hydraulic engines and rams; set of Westinghouse air-brake apparatus, air-compressors, compressed air engine, blower and ventilating fans; belt machines, lubricant and oil testers; Robinson experiment steam boiler, with natural, forced, and induced drafts, air-preheater, and economizer; calorimeters, injectors, gauges. The University power and refrigerating plants and the mechanical equipments in the different buildings upon the grounds add to the facilities for engineering tests.

Besides the above, opportunities frequently arise for the students to take part in tests made of machinery, engines, and boilers in the city and vicinity.

3. MECHANISM. Five credit hours. Mechanical Engineering, third year, second term, *M., Tu., W., Th., F., at* 8. Prerequisite, Drawing 33 and Physics 2.

Lectures and recitations on the principles of mechanism and mechanical movements. Two credit hours. Mechanical Engineering, third year, third term. Time to be arranged. Professor HITCHCOCK and Assistant Professor KING.

The accurate laying laying out of movements, embodying the principles of mechanism.

12. EXPERIMENTAL ENGINEERING LABORATORY. Two credit hours. Mechanical Engineering, third year, first term, *W.,* 1 *to* 5; *S.,* 8 *to* 12. Industrial Arts, fourth year, first term, *Th.,* 1 *to* 5. Prerequisite, Drawing 33. Concurrent, Mechanics 1, or Industrial Arts 3. Assistant Professor KING and Mr. WILCOX.

Calibration of pressure gauges and indicator springs; steam engine indicator practise and oil testing.

14. Continuation of 27. Four credit hours. Mechanical Engineering, fourth year, second term, *M., W.,* 1 *to* 5. Concurrent, Mechanical Engineering 34. Professor HITCHCOCK, Assistant Professors JUDD and KING.

Testing of steam boilers and injectors.

15. Continuation of 14. Three credit hours. Mechanical Engi-

neering, fourth year, third term, *M., Tu.,* 9 *to* 12. Professor HITCHCOCK, Assistant Professors JUDD and KING.

Testing of steam, centrifugal, and power pumps, pulsometer, hydraulic rams, impulse and turbine water-wheels and air compressors.

17. EXPERIMENTAL ENGINEERING. Three credit hours. Civil Engineering, fourth year, second term, *Th., at* 11; *F.,* 1 *to* 5. Prerequisite, Drawing 33, and Mechanics 3. Professor HITCHCOCK, Assistant Professors JUDD and KING.

Practise in the testing of materials of construction, calibration of orifices and weirs, study of the flow of liquids and gases, accompanied by lectures and recitations on steam engines, boilers, and power transmission.

18. MACHINE DESIGN. Five credit hours. Chemical and Mechanical Engineering, fourth year, first and second terms, *M., Tu., W., Th., F., at* 9. Prerequisite, Drawing 5 or 33; Mechanics 3. Professor MAGRUDER.

Recitations on Unwin's Machine Design, with lectures on American practise.

19. MACHINE DESIGN. Five credit hours. Chemical and Mechanical Engineering, fourth year, third term, *M.,* 1 *to* 5; *Tu., W.,* 1 *to* 4. Prerequisite, Mechanical Engineering 18. Professor MAGRUDER.

Practical applications of the principles of machine designs.

21. THESIS WORK. Five credit hours. Mechanical Engineering, fourth year, third term. Professors MAGRUDER and HITCHCOCK.

23. MATERIALS OF CONSTRUCTION. Five credit hours. Architecture, fourth year, first term, *Tu., Th., at* 8; *W.,* 1 *to* 5. Prerequisite, Mechanics 1. Professor HITCHCOCK.

Lectures and recitations on the materials used in architectural and building construction, and laboratory exercises on their properties.

24. EXPERIMENTAL ENGINEERING LABORATORY. Three credit hours. First and second terms. Elective to third and fourth year engineers. (Not given in 1907-1908.)

Arranged to meet the needs of those desiring to elect advanced laboratory work.

25. Continuation of 17. Five credit hours. Civil Engineering, fourth year, third term. *Th., at* 11; *M., Tu.,* 1 *to* 5. Professor HITCHCOCK, Assistant Professors JUDD and KING.

Tests of steam, power, rotary, and centrifugal pumps; water motor and turbine wheel.

27. Continuation of 12. Five credit hours. Mechanical Engineering, fourth year, first term, *M.,* 1 *to* 5; *F.,* 10 *to* 5. Concurrent,

Mechanical Engineering 33. Professor HITCHCOCK, Assistant Professors JUDD and KING.

Testing materials of construction, tests of steam and hot-air engines, transmission and absorption, dynamometer trials, and testing of belts.

28. EXPERIMENTAL ENGINEERING LABORATORY. Two credit hours. Electrical Engineering, third year, third term, *Th., or F.,* 1 *to* 5. Manual Training, fourth year, third term, *F.,* 1 *to* 5. Concurrent, Mechanical Engineering 32. Assistant Professors JUDD and KING, and Mr. WILCOX.

Testing of pressure gauges and indicator springs, steam engine indicator practise, and testing of lubricating oils.

29. Continuation of 28. Three credit hours. Electrical Engineering, fourth year, first term, *Tu., or Th.,* 10 *to* 12, 1 *to* 5. Two credit hours. Industrial Arts, fourth year, second term, *W.,* 1 *to* 5. Assistant Professors JUDD and KING, and Mr. WILCOX.

Testing materials of construction, transmission and absorption dynamometer tests, steam engine trials.

30. Continuation of 29. Two credit hours. Electrical Engineering, fourth year, second term, *Tu., or Th.,* 1 *to* 5. Industrial Arts, fourth year, third term, *F.,* 1 *to* 5. Assistant Professors JUDD and KING, and Mr. WILCOX.

Steam engine and boiler trials, steam and power pump tests, hydraulic experimentation, gas and oil engine trials.

31. HYDRAULIC MACHINERY. Three credit hours. Mechanical Engineering, fourth year, third term, *Tu., Th., at* 8; *W., at* 9. Prerequisite, Mechanics 3 and Mechanical Engineering 33. Professor HITCHCOCK.

Recitations and lectures on pumping machinery.

32. MECHANICAL ENGINEERING OF POWER PLANTS. Five credit hours. Chemical and Electrical Engineering and Industrial Arts, third year, third term, *M., Tu., W., Th., F., at* 9. Mechanical Engineering, third year, third term, *M., Tu., W., Th., F., at* 8. Manual Training, fourth year, third term, *M., Tu., W., Th., F., at* 8. Prerequisite, Mechanical Engineering 3, or Industrial Arts 1; Drawing 5 or 22, and Physics 2. Professor MAGRUDER.

A descriptive study of steam and gas engines, boilers, pumps, injectors and other machinery used in plants generating power.

33. STEAM ENGINES AND BOILERS. Five credit hours. Electric and Mechanical Engineering, fourth year, first term, *M., Tu., W., Th., F., at* 8. Prerequisite, Mechanics 3 and Mechanical Engineering 32. Professor MAGRUDER.

A detail study of steam using and steam generating machinery.

34. THERMODYNAMICS. Five credit hours. Mechanical Engineering, fourth year, second term, *M., Tu., W., Th., F., at* 8. Prerequisite, Mechanical Engineering 33. Professor MAGRUDER.

The transmutations of heat and mechanical energies in steam, gas, and air engines, in air and ammonia compressors and in refrigeration machines, together with a study of the tests of ideal and actual engines and of their indicator diagrams; the flow of gases through pipes and orifices.

35. EXPERIMENTAL ENGINEERING LABORATORY. Five credit hours. Option, Chemical Engineering, fourth year, second term, *F., at* 11; *Th., F.,* 1 *to* 5. Prerequisite, Mechanics 3 and Mechanical Engineering 32. Assistant Professors JUDD and KING.

Testing of pressure gauges and indicator springs followed by steam engine indicator practise with engine and pump economy tests; testing of lubricating oils; ventilating fan trials and boiler fuel tests; accompanied by lectures relating to apparatus used in the experimentations.

36. EXPERIMENTAL ENGINEERING LABORATORY. Five credit hours. Ceramics and Mine Engineering, fourth year, third term, *Tu., Th.,* 10 *to* 11; *W., Th.,* 1 *to* 4. Prerequisite, Mechanics 3 and Metallurgy 4. Professor HITCHCOCK, Assistant Professors JUDD and KING.

Lectures and recitations on power transmission, steam engines and boilers. Laboratory; testing pressure gauges, indicator springs, etc.; valve setting; testing of steam engines, steam, power and centrifugal pumps; boiler and fuel trials.

37. MECHANISM. Four credit hours. Ceramics and Electrical Engineering, third year, second term, *M., Tu., Th., F., at* 10. Professor HITCHCOCK, Assistant Professor KING.

Lectures and recitations on the principles of mechanism and mechanical movements.

38. INSPECTION TRIP TO THE EAST. Given only in the even years. Mechanical Engineering, third or fourth year.

Includes Pittsburg, Buffalo, Niagara Falls, Cleveland, and possibly other places; is taken at the end of the winter term, and occupies six days. The entire expense need not exceed $30.00. A satisfactory written report upon the work of the trip is required.

39. INSPECTION TRIP TO THE WEST. Given only in the odd years. Mechanical Engineering, fourth or third year.

Includes Chicago, Milwaukee, Cincinnati, and possibly other places; is taken at the end of the winter term and occupies six days. The entire expense need not exceed $30.00. A satisfactory written report upon the work of the trip is required.

40. WRITTEN REPORT. Course of assigned reading upon processes of manufacture and power plants may be reported upon by third and fourth-year students in the Mechanical Engineering as a substitute for 38 on presentation of reasons satisfactory to the head of the department.

41. Similar to 40. A substitute for 39.

42. HEATING AND VENTILATING. Three credit hours. Architecture, fourth year, second term, *M., W., F., at* 11. Professor HITCHCOCK.

Recitations and lectures on the principles and methods of heating and ventilation, with laboratory work and investigations of the heating and ventilating plants of different buildings.

MECHANICS

(Office, Mines Building, Room 219.)

PROFESSOR BOYD, ASSISTANT PROFESSOR CODDINGTON, MR. KINDLE.

1, 2, 3. MECHANICS. Formerly Mathematics 71, 72, 73. Five credit hours. Architecture, Ceramics, Chemical Engineering, Civil Engineering, Electrical Engineering, Mechanical Engineering, Mine Engineering, third year, three terms. *M., Tu., W., Th., F., at* 8, 9, *or* 11. Prerequisite, Mathemics 43. Professor BOYD, Assistant Professor CODDINGTOK, Mr. KINDLE.

METALLURGY AND MINERALOGY

(Office, School of Mines Building.)

PROFESSOR N. W. LORD, ASSOCIATE PROFESSOR SOMERMEIER,
MR. DEMOREST.

The equipment of the Department of Metallurgy is unusually complete. It occupies about 14,000 square feet of floor space in the new School of Mines building, which has just been built and equipped at a cost of $110,000. It includes a chemical laboratory with accommodations for forty students, an assay laboratory in a fire-proof wing, laboratories for general and determinative mineralogy, technical gas analysis, coal sampling and testing, including determinations of heating value, microscopic metallographic work, crushing and sampling plant for use in experimental tests on ores and minerals, together with lecture rooms, museum, and offices.

2. MINERALOGY. Three credit hours. Chemical and Mine Engineering, second year, third term, *M., W., F., at* 11. Prerequisite, Chemistry 12. Lectures arranged so as to be preparatory to Determinative Mineralogy. Professor LORD.

3. DETERMINATIVE MINERALOGY. Five credit hours. Mine Engineering, third year, third term, *M., Tu.,* 1 *to* 5. Prerequisite, Metallurgy 2. Professor LORD, Associate Professor SOMERMEIER.

Lecture and laboratory work in practical determination of minerals by physical and chemical tests. Each student is furnished with a set of apparatus and works under an instructor's inspection. Brush's Determinative Mineralogy is used as a manual.

4. METALLURGY. Five credit hours. Mine Engineering, third year, first and second terms. Option, Chemical Engineering, fourth year, first and second terms. Industrial Arts and Mechanical Engineering, third year, first term and first two-fifths of second term. Ceramics, fourth year, first term, *M., Tu., W., Th., F., at* 9. Prerequisite, Chemistry 12, and Physics 2. Professor LORD.

A course of lectures upon fuel and its uses, iron and steel, copper, lead, gold and silver, their properties, tests, ores, and details of the methods of reduction. The lectures are supplemented by a careful study of references to standard works and journals.

5. METALLURGICAL LABORATORY. Five credit hours. Mine Engineering, second year, first, second, and third terms. Chemical Engineering, third year, first term, *W., Th., F.,* 1 *to* 4. Prerequisite, Chemistry 12. Associate Professor SOMERMEIER.

Lectures and laboratory work. Laboratory practise in the analysis of iron and steel, fuel and slags, and the assay of lead, copper, and zinc ores by wet methods, using approved methods as practised in technical laboratories and metallurgical works.

6. ASSAYING. Five credit hours. Mine Engineering and Chemical Engineering, third year, second term, *M., Tu., at* 11; 1 *to* 5. Prerequisite, one term of Metallurgy 5. Professor LORD, Associate Professor SOMERMEIER.

Lectures and laboratory work. Practical work in the assaying of gold, silver, and lead ores, by furnace methods.

7. METALLURGICAL CONSTRUCTION. Three credit hours. Mine Engineering, fourth year, second term, *Th., F.,* 1 *to* 4. Prerequisite, Drawing 5, Mechanics 3, Metallurgy 4 and 8. Professor LORD, Professor RAY.

Lectures and drawing room practise in the designing of furnaces and other metallurgical machinery, including detail drawings and estimates.

8. ORE DRESSING AND COAL WASHING. Two credit hours Mine Engineering, fourth year, first term, *Tu., F., at* 10. Prerequisite, Metallurgy 4. Professor LORD.

Methods of concentrating and enriching ores and fuels by mechanical means. Lectures with reference to standard books and various papers in technical journals.

9. MINERAL CHEMISTRY. Five credit hours. Short Mining, second year, third term, *M., Tu., W., Th., F., at* 8. Prerequisite, Chemistry 3. Professor LORD.

Lectures upon fire-damp, mine explosions, explosives, boiler waters, mine gases, iron ores; iron and steel, their properties and modes of manufacture; coal and coke.

MILITARY DRILL

(Office, Armory.)

CAPTAIN GEORGE L. CONVERSE, U. S. A., RETIRED.

The same building used as a gymnasium is also employed as Armory and Drill Hall. The University Regiment is in charge of a commandant from the United States Army, apart from whom it is officered entirely by students. Besides its military importance, as shown by the prominent place taken by former students in the Ohio troops of the late war and in the United States Army, military drill has great value in the physical development of the student.

The fall work is carried on outdoors, weather permitting, and is largely devoted to squad drill in the setting-up exercises, facings, marching, etc., and company drill according to progress of the squads. During the winter months drill is confined to work inside the gymnasium, manual of arms, guard mounting and such ceremonies as can be performed within a limited space. After April 1st all work is again outside, weather permitting, as follows: Mondays, company drill; Tuesdays, battalion drill; Wednesdays, ceremonies other than guard mounting. During the entire year, at the same hours as the drill, the University Band either has its practise hour or takes part in ceremonies and drill.

Army regulations are followed strictly. The military department is open five days per week of each term.

1. MILITARY DRILL. Three times a week, from the opening of College until the Christmas vacation. Theoretical work three times a week; winter term until April first; three times a week until the close of the school year. Required of all able-bodied male students during first and second years of their course.

2. TACTICS. Lectures and recitations. Three times a week. Second term.

MINE ENGINEERING

(Office, School of Mines Building.)

PROFESSOR RAY, MR. SIMON.

This department is equipped with all of the latest improved instruments and apparatus used in mine engineering, surveying, and the study of mine ventilation. There is a collection of models of mine machinery and supplies, to which additions are being made; also a large collection of lantern views of machines, mines, and mine equipment. In the drafting room each student is personally taught the making of maps, the platting of actual surface and underground surveys, the making of drawings, tracings, and blueprints. Emphasis is laid upon proper methods of keeping notes and all records necessary to an efficient engineer's office. The students make actual surveys of coal mines, and work up their notes complete in all of the necessary details. They are also taught how to make working drawings, plans, estimates, and specifications of mining operations and equipment.

The Mine Engineering Course pays special attention to underground surveying, mapping, timbering, ventilation, and other matters relating to safety and speed, system and method in extracting coal and other minerals. The coal mines of Central Ohio furnish extremely valuable illustrations of the practise in these lines, and of the general arrangement of mining plants. The mining students are required to make frequent trips and to spend sufficient time at the mines in actual work and observation to become familiar with practical mine surveying and the details of mine equipment and management.

1. MINE SURVEYING. Five credit hours. Short Mining, second year, first term, *M., Tu., W., Th., F., at* 11. Prerequisite, Mathematics 14.

Lectures and field practise. This is similar to Course 4, but more elementary. The same text is used. The students have more practise in the drawing room.

2. VENTILATION AND HAULAGE. Five credit hours. Short Mining, second year, second term, *M., Tu., W., Th., F., at* 11. Prerequisite, Mine Engineering 1, and Physics 1.

Lectures illustrated by experiments and maps of mines and models when possible, tests by safety lamps and anemometers, and methods of air distribution in coal mines.

3. MINE OPERATING. Five credit hours. Short Mining, second year, third term, *Tu., Th., F., at* 10; *M.,* 9 *to* 11. Prerequisite, Mine Engineering 2.

A course of lectures and practical instruction in mine bookkeeping and accounts, cost of working, etc., particularly adapted to Ohio coal mining.

4. MINE SURVEYING. Five credit hours. Mine Engineering and Ceramics, third year, first term, *M., Tu., Th., F., at* 10; *M.,* 1 *to* 3. Prerequisite, Drawing 33, and Mathematics 32.

Field practise in the use of instruments for surface and underground surveys. Full notes are taken and maps and plans made in the drawing-room. Davies's Surveying by Van Amringe is used as a text-book.

5. MINE ENGINEERING. Five credit hours. Lectures. Mine Engineering, fourth year, first, second and third terms, *M., Tu., W., Th., F., at* 8. Prerequisite, Mechanics 3, and Mine Engineering 4. Concurrent, Geology 2.

Mine operating, mining machinery, ventilation, shaft-sinking, working out deposits, etc. Constant reference is required to the standard works and to the leading technical journals, with practise in designing mine plants, drafting, and estimates.

6. PLANS AND SPECIFICATIONS. Five credit hours. Mine Engineering, fourth year, third term, *M., F., at* 10; *M., Tu.,* 1 *to* 4. Prerequisite, Metallurgy 7, and Mine Engineering 5.

7. SURVEYING. One credit hour. Mine Engineering, third year; Short Mining, second year; second term. Prerequisite, Mine Engineering 1 or 4.

Practical experience in surveying in some mine convenient to Columbus; the time taken in one trip not more than four consecutive days.

PHYSICS

(Office, Physics Building, First Floor.)

PROFESSOR THOMAS, PROFESSOR COLE, ASSISTANT PROFESSOR KESTER, ASSISTANT PROFESSOR EARHART, MR. BAILEY, MR. MOODY.

The department of Physics occupies the three stories and basement of the new Physics Building, a building in the design and construction of which special care has been taken to secure ample light, ventilation, and rigidity of floors and supports. The floor area of the building is thirty thousand square feet. The two wings included in the plan of the building will, when erected, add twenty-five thousand square feet of floor area. The department has a generous supply of apparatus for the experimental illustration of the lecture courses, and for elementary and advanced laboratory work. The best instrument makers of this and foreign countries are well represented in the equipment, which is especially strong in standards, and in apparatus for precise measurement.

1. ELEMENTARY PHYSICS. Recitations, experimental lectures and laboratory. Text: Millikan & Gale "Elements of Physics." Five credit hours. Short Mining, first year, first and second terms, *M., Tu., W., F., at* 8, and one three-hour laboratory period, any afternoon, 1 to 4, or Saturday morning. Short Clay-working and Industrial Arts, second year, first and second terms, *M., Tu., W., F., at* 11, and one laboratory period, as above. Prerequisite, Mathematics 14. Dr. EARHART.

2. GENERAL PHYSICS. Three credit hours. All four-year courses, second year, first, second, and third terms, *M., W., at* 9, *or Tu., Th., at* 11. Quiz to be arranged. Prerequisite, Mathematics 33. Professor THOMAS.

3. PHYSICS. Two credit hours. Extension of Course 2, with practise in solution of problems. Electrical Engineering, Ceramics, Industrial Arts, and Manual Training, second year, first, second, and third terms, *Tu., Th., at* 9. Concurrent, Physics 2.

4. ELECTRICITY AND MAGNETISM. Three credit hours. Lectures and recitations. Electrical Engineering, third year, first term, *M., Tu., Th., at* 10. Prerequisite, Mathematics 43, and Physics 2 and 3. Professor THOMAS.

5. PHYSICAL LABORATORY. Four credit hours. Electrical Engineering, second year, third term, *M., Tu.,* 1 *to* 4; *W.,* 1 *to* 3, *or Th., F.,* 1 *to* 4; *S.,* 8 *to* 10. Option, Manual Training, third year, first,

second, and third terms, *M., Tu.,* 1 *to* 4; *W.,* 1 *to* 3. Prerequisite, Physics 2.

Elementary manipulation. Length, mass and time measurements. Work in density, elasticity, and in heat.

6. PHYSICAL LABORATORY. Five credit hours. Electrical Engineering, third year, first and second terms, *M., Tu., W.,* 1 *to* 4. Prerequisite, Physics 5. Concurrent, Physics 4.

Theory and practise of magnetic and electrical measurement, including the testing and standardizing of instruments; conductivity of conductors; insulation, capacity and resistance of insulated conductors and cables; temperature co-efficients; commercial measuring and testing instruments; strength and distribution of magnetic fields; magnetic movements, permeability; work in light, including optical constants; spectroscopy; photometry of gas, electric and other lights.

7. PHYSICAL LABORATORY. Two credit hours. Mechanical Engineering, second year, second term, *M., Tu.,* 1 *to* 3, *or Th., F.,* 1 *to* 3. Three credit hours. Mechanical Engineering, second year, third term, *M., Tu.,* 1 *to* 4, *or Th., F.,* 1 *to* 4. Three to five credit hours. First, second, and third terms. Elective. Concurrent, Physics 2.

9. PHYSICAL LABORATORY. Three to five credit hours. A second year's work in Physical Laboratory. Elective. Prerequisite, Physics 6 or 7.

POLITICAL SCIENCE

(See American History and Political Science.)

ROMANCE LANGUAGES AND LITERATURES

(Office, Room 305, University Hall.)

PROFESSOR BOWEN, ASSOCIATE PROFESSOR BRUCE, ASSISTANT PROFESSOR INGRAHAM, ASSISTANT PROFESSOR PEIRCE, MISS HASKELL.

I. FRENCH.

1. ELEMENTARY FRENCH. Four credit hours. Three terms. Grammar: Fraser and Squair's or equivalent. Reader: Aldrich and Foster's, Bowen's First Scientific. Historical and narrative prose; one or more prose comedies. Sec. I, *M., Tu., Th., F., at* 9 (Arts only). Sec. II and III, *M., Tu., Th., F., at* 10. Sec. IV, *M., Tu., Th., F., at* 11 (Ag. and Engin. only). Sec. V and VI, *Tu., W., Th., F., at* 2. Sec. VII, *Tu., W., Th., F., at* 3.

Required of all students who offer partial credit in French as their entrance language. Offered as alternative with German 1 and Spanish 1 to all students who enter with full or partial credit in Latin or Greek, or without previous language training.

2. MODERN FRENCH LITERATURE. Four credit hours. Sec. I, *M., Tu., Th., F., at* 10. Sec. II, *M., Tu., Th., F., at* 11. Sec. III, *Tu., W., Th., F., at* 1. Prerequisite, Course 1 or equivalent. Associate Professor BRUCE, Assistant Professor PEIRCE, Miss HASKELL.

The study of the literature as such is taken up, the work of the year covering two or more of the following subjects: (1) Contes; (2) The Novel (Balzac or Hugo); (3) Lyric Poetry (Bowen's Modern French Lyrics); (4) Romantic Drama (Hugo). Prose Composition. Lectures. Private reading required. Special emphasis of syntax and idiom.

3. SCIENCE READING. Four credit hours. Third term. *Tu., W., Th., F., at* 2. Prerequisite, Course 2, first and second terms. Assistant Professor INGRAHAM.

Herdler's Scientific Reader and Luquiens' Popular Science, or other similar works. A course of rapid reading introductory to the vocabulary of scientific literature.

II. SPANISH

1. ELEMENTARY SPANISH. Four credit hours. Three terms. Grammar: (Hill's and Ford's or Edgren's), and Ingraham's Victoria y Otros Cuentos. Easy prose and plays. Composition and conversation. Sec. I, *M., Tu., Th., F., at* 9. Sec. II, *M., Tu., Th., F., at* 11. Sec. III and IV, *Tu., W., Th., F., at* 2. Assistant Professor INGRAHAM, Assistant Professor PEIRCE, Miss HASKELL.

Required of all students who offer partial credit in Spanish as their entrance language. Offered as alternative with French 1 and German 1 to all students who enter with full or partial credit in Latin or Greek, or without previous language training.

2. MODERN SPANISH LITERATURE. Four credit hours. Three terms. *Tu., W., Th., F., at* 3. Prerequisite, Course 1 or equivalent. Assistant Professor INGRAHAM.

The Modern Novel and Drama. Lectures covering a survey of the literature. Composition and conversation continued.

SHOP WORK

(See Industrial Arts.)

SPANISH

(See Romance Languages.)

THE STILLMAN W. ROBINSON FELLOWSHIP IN ENGINEERING

The Stillman W. Robinson Fellowship in Engineering, endowed by Emeritus Professor Robinson for the encouragement of graduate research work in engineering, provides three hundred ($300.00) dollars annually, and is open to graduates in Mechanical, Civil, and Electrical Engineering. Any student to whom this fellowship is awarded must devote his entire time to the work, which shall amount to at least sixteen hours per week, of which at least eight shall be in the line of original research or investigation.

This fellowship will be awarded on the Friday preceding Commencement Day. All applications must be filed with the committee on or before the first of June of the same year, and must include a general outline of the course of study and research proposed. This must show a definite object to be attained. The application may be for one or two years, preference being given to candidates electing the two-year course. No one will be registered for this graduate course of research who does not satisfy the committee of the Faculty that he has the necessary capacity, fitness, and preparation to pursue the work with advantage, and promise of ultimate success.

Great importance will be attached not only to the course laid out to be pursued by the applicant, but to his personal fitness for the work and to his ability to prepare a dissertation or thesis respecting the same which shall be in every way a creditable production, and form a contribution to knowledge. The investigation may consist of experimental research, or of mathematical analysis, but it usually will be expected to embrace both forms of study. By the beginning of the first year the student must have prepared and submitted a well-defined course, and have registered for this fellowship. Throughout the course of study the student will proceed under the care of the professor who has charge of the line of work being pursued, the same consisting of occasional consultation, instead of recitations.

Students completing the two-year graduate course under the conditions of this fellowship will receive the degree of D. M.E., D. C.E., or D. E.E., according to the course taken. Students electing and completing a one-year course will receive the corresponding Master's degree.

The applications for this fellowship, the approval of the courses of study, the acceptance of the theses, and the recommendations for degrees, are to be passed upon by a committee of the Faculty consisting of the President of the University, the Dean of the College of Engineering, and the professors of Mechanical Engineering, Experimental Engineering, Civil Engineering, Electrical Engineering, and Mathematics.

FEES AND EXPENSES

GENERAL CHARGES

All term dues must be paid at the opening of each term as a condition of admission to classes.

INCIDENTAL FEE.—A charge of six dollars a term, or eighteen dollars a year, is made against all students, under the head of incidental expense. In the case of former students, if this fee is not paid until the second day of the term, one dollar will be added, and for each succeeding day of delinquency, fifty cents will be added.

TUITION.—Tuition is free in the College of Engineering.

LABORATORY FEES.—Students in all laboratory courses are required to pay a flat fee of one dollar per term for each laboratory course taken. The sums thus derived are to cover in part the loss and deterioration of the expensive instruments used by them. In addition, an effort is made in each department to assess upon the students of each laboratory course the cost of the supplies and materials consumed by them. These fees vary considerably in different departments, and they are generally collected in the form of cash advances when the student enters, the unexpended balance being returned to him at the end of the term.

In those departments where the laboratory work is chemical, the student buys a card for five dollars at the beginning of the course, and from that card is supplied with chemicals and apparatus as he needs them, the value of each purchase being punched out of the card at the time. When the card is exhausted, another must be purchased. The store room redeems all unused cards at face value. In addition a deposit of five dollars is required as security against breakage or loss of the equipment of the desks, which is not supposed to be worn out or consumed, as in the case of chemicals.

GYMNASIUM LOCKER FEE.—A fee of one dollar a term is required from those who make use of a locker in the gymnasium.

CADET UNIFORMS.—The uniform with which the members of the battalion are required to provide themselves costs (without overcoat) about fourteen dollars. It is quiet in pattern, and is designed to be worn in place of civilian dress.

GRADUATION FEE.—A fee of five dollars, to cover expense of graduation and diploma, is required of each person reciving one of the ordinary degrees from the University and this fee must be paid before the degree is conferred. A like fee of ten dollars is charged to each person receiving one of the higher graduate degrees.

TOTAL AMOUNT OF FEES

The element of economy on the part of the student enters somewhat into the cost of pursuing laboratory courses. For this reason it is impossible to fix accurately the costs for a term or a year. In pursuing the courses of the College of Engineering, it is not likely that a student could get through a year's work with an expenditure in fees of less than thirty ($30.00) dollars, nor is it likely that the amount would ever exceed fifty ($50.00) dollars, except in cases of fines being assessed for gross carelessness or needless detruction of property.

ROOMS AND BOARD

The South Dormitory affords unfurnished rooms for students who desire to board themselves and thus reduce their expenses to a minimum. The expense of living in this way is about two dollars per week. Applications for rooms should be made to the President of the University.

Boarding clubs are also formed in the neighborhood of the University. Furnished rooms are rented at seventy-five cents to one dollar a week for each student, and the cost of table board is two dollars to three dollars a week.

Board with furnished rooms can be obtained in private families, within convenient distance of the University, at rates varying from three and a half to five dollars per week. The ruling rate may be taken as four dollars.

ESTIMATE OF EXPENSES

	**Low*	*Average*	*High*
Incidental fees	$ 18 00	$ 18 00	$ 18 00
Laboratory fees	15 00	30 00	54 00
Books and stationary	15 00	25 00	50 00
Room	4 50	45 00	75 00
Board	.....	126 00	180 00
Laundry	10 00	20 00	30 00
Miscellaneous	10 00	30 00	75 00
Uniform	14 00	14 00	14 00
Furniture	15 00	.....	.....
Food and supplies	75 00	.....	.....
	$176 50	$308 00	$496 00

SELF SUPPORT.—There is considerable amount of work upon the farm and in the shops and laboratories of the University which may be assigned to students on application. Preference is given to those studying Agriculture or one of the Engineering courses. *The University cannot promise work to all applicants.* Many students find work in private families, in offices and in various occupations, by means of which they defray at least a portion of their expenses. A person of ability and energy, who is master of a trade or who can do good work of any kind, can generally find remunerative employment. It has seldom been known that any student of ordinary energy and industry was obliged to leave the University because of a lack of money for necessary expenses, after having been sixty days on the ground—or long enough to inform himself as to the opportunities for securing employment. As an accommodation the executive office co-operates as far as possible in this matter. The Y. M. C. A. offers its services in helping young men to secure employment. Very much depends, however, on the individual's power of initiative. Students should not come to the University expecting others to find places for them. They should report to the executive office from time to time as to their needs and their work. This will enable the authorities to be more helpful than otherwise would be possible.

---

*Student renting unfurnished room and cooking for himself.

A student devoting much of his time to earning his way will be unable to carry successfully the full amount of collegiate work. Such students should apply for the privilege of carrying reduced work. This, of course, means that the time required to obtain a degree will be extended to five or more years, according to the amount of work successfully carried each year.

GENERAL INFORMATION

REGISTRATION.—All students are required to register and pay their term fees on or before the first day of each term between the hours of 8 a. m. and 12 m., or between 1 and 4 p. m., central standard time. No candidate for graduation will be permitted to register for the second term of his graduating year, except upon presentation to the Bursar of the President's certificate that his thesis subject has been announced and approved.

AMOUNT OF WORK.—No student is permitted to take less than fifteen credit hours a week of any sort of work, except by special permission, and no student will be permitted to take more than the regular work of the class to which he belongs, who has not passed all his work for the preceding term.

CREDIT HOURS.—"Two consecutive hours of practical or experimental work in any department shall be regarded as the equivalent of one hour of class-room exercise; but when no outside work is required in addition to the laboratory work, then three hours of laboratory work may be required as equivalent to one credit hour; and in general not more than three hours of the student's time, including class hours, shall be required for each credit hour."

CONSULTATION.—For consultation regarding work in any class or department, students will apply to the professor or instructor in charge.

For consultation in regard to their status as members of the College of Engineering, or for the filing of petitions, changes of course, changes of class cards, adjustment of schedules and similar needs, students will apply to the Secretary, Brown Hall, Room 22, from 9 to 10 a. m.

On matters connected with the discipline of the institution, students will apply to the President of the University.

PROBATION.—At the close of any term a student failing to pass in two-thirds of his work will be considered on probation for the next three terms; and a second similar failure incurred while thus on "probation" will forfeit his connection with the University.

ENROLLMENT*

April 16, 1907.

STUDENTS IN FOUR-YEAR COURSES LEADING TO DEGREES	741
STUDENTS IN SHORT COURSES NOT LEADING TO DEGREES	47
SPECIAL STUDENTS	19
Total	807

CLASSIFICATION BY COURSES

Name of Course Pursued	4th year	3rd year	2nd year	1st year	2nd yr. short	1st yr. short	Special	Total
Unclassified	....	....	....	256	....	....	....	256
Architecture	3	5	8	Unclassified	....	....	....	16
Ceramics	2	13	29		9	10	..	63
Chemical Engineering	6	10	9		....	....	....	25
Civil Engineering	31	33	67		....	....	....	131
Electrical Engineering	36	38	54		....	....	....	128
Industrial Arts	1	2	1		4	9	....	17
Manual Training	....	1	....		....	....	....	1
Mechanical Engineering	21	22	39		....	....	....	82
Mine Engineering	13	18	23		7	8	....	69
Special, Unclassified	....	....	....		....	....	19	19
Total	113	142	230	256	20	27	19	807

NOTE:—For list of names, consult the General Catalogue of the University, which will be sent on application.

SUMMARY OF GRADUATES

Architecture (C. E. in Arch.)	4
Ceramics (E. M. in Cer.)	10
Chemistry (B. Sc. in Chem.)	26
Civil Engineering (C. E.)	161
Electrical Engineering (M. E. in E. E.)	173
Industrial Arts (B. Sc. in Ind. Arts)	3
Mechanical Engineering (M. E.)	139
Mine Engineering (E. M.)	85
Master of Science, Conferred by College of Engineering	2
Total Degrees Conferred	609
Names Counted Twice	8
Total Number of Graduates	601

DIRECTORY OF GRADUATES

March 14, 1907.

The University is anxious to place a copy of each annual bulletin in the hands of the graduates of the College of Engineering. It will be esteemed a favor if any alumnus who changes his residence will notify the Secretary of the University Faculty of the new address and occupation.

A

Ackerman, Eli O., 1884, C. E. Station "B," Columbus, Ohio.	Engineer, Maintenance of Way Columbus Railway & Light Co.
Ackerman, Fremont, 1883, C. E. Los Angeles, California.	Civil Engineer.
Aldrich, Edgar S., 1897, E. E. Moscow, Idaho.	Vice President and Manager Moscow Electric Light & Power Co.
Alexander, C. P., 1896, E. E. Akron, Ohio.	Instructor in Physics, High School.
Alexander, St. C., 1893, E. E. Kansas City, Mo.	In Stock Yards.
Alsdorf, Fred C., 1892, E. M. Clifton, Arizona.	Superintendent, Stevens Copper Co.
Alsdorf, Percy Reed, 1896, E. M. Central City, Colorado.	Essayer and Chemist in Standard Assay Office.
Alsdorf, Robert C., 1904, M. E. 1508 Union St., Schenectady, N. Y.	Turbine Dept., Gen. Elec. Co.
Ames, Edward H., 1903, C. E. 70 N. Fourth St., Columbus, Ohio.	Transitman, City Engineer's Office.

Arnold, Edwin E., 1898, M. E. Wilkinsburg, Pa.	Engineer, Westinghouse Machine Company.
Asher, Clyde B., 1905, C. E. Bellevue, Pa.	Engineer for National Fireproofing Co.
Atkinson, Warren, 1899, M. E. 125 W. 127th St., N. Y.	Electrical Dept., New York Telephone Co.
Auld, James A., 1897, E. E.	Eng. Dept., General Electric Co.

B

Bailey, Ervin G., 1903, M. E. Fairmount, W. Va.	With Fairmount Coal Co.
Barcus, Miner, 1897, E. E. Schenectady, N. Y.	Engineering Dept., General Electric Co.
Barianbrock, Chas. H., 1905, C. E. Mt. Vernon, Ohio.	With Mt. Vernon Bridge Co.
Barnaby, C. L., 1898, C. E. Fort Wayne, Ind.	Engineer Maintenance of Way Dept., G. R. & I. Ry.
Barringer, L. E., 1902, E. M. Schenectady, N. Y.	In Research Dept., General Electric Co.
Barrows, Harry H., 1898, C. E. Lexington, Ky.	Division Engineer, Q. & C. Route.
Barry, William J., 1903, C. E. Doanville, Ohio.	Chief Engineer, Columbus & Hocking Coal & Iron Co.
Bartholomew, Harold C., 1906 E. E. Cincinnati, Ohio.	Student Apprentice, Allis-Chalmers Co.
Beach, David Price, 1895, C. E. Zanesville, Ohio.	Engineer Maintenance of Way, C. & M. V. Ry.
Beach, Howard L., 1904, E. E. Wilkinsburg, Pa.	Engineer, Westinghouse Elec. Mfg. Co.
Bebout, Guy B., 1905, C. E. Columbus, Ohio.	In City Engineer's Office.
Beck, Arthur A., 1893, C. E. Columbus, Ohio.	Engineer.
Belden, Sanford B., 1895, E. M. Pittsburg, Pa.	Manager Pittsburg Office, Jeffrey Manufacturing Co.
Bell, Wakeman C., 1905, C. E. Salem, Ill.	Asst. on Engineering Corps, Chicago & Eastern Illinois R. R.
Benedict, E. W., 1904, E. E. Waterbury, Conn.	New England Eng. Co.
Berger, Edwin L., 1906, E. M. Bucyrus, O.	
Beutler, Frank E., 1906, E. E. 5029 Linden Ave., Norwood, O.	Student Apprentice.
Biebel, Herman M., 1896, E. E. Hawthorn, Ill.	Electric Engineer, Western Electric Co.
Billings, Edward J., 1906, M. E. St. Louis, Mo.	Fuel Testing Plant, U. S. Geological Survey.
Bischoff, John W., 1899, E. M. 322 I Street, S. W., Washington, D. C.	

BISSING, WILLIAM, 1893, E. E. 49 Wall St., New York City.	Patent Attorney.
BLACKBURN, F. H., 1896, E. E. St. Louis, Mo.	Superintendent, Columbia Incandescent Lamp Co.
BLEININGER, A. V., 1901, B. Sc. Columbus, Ohio.	Associate Professor of Ceramics, Ohio State University.
BLOOM, J. GEORGE, 1899, C. E. Topeka, Kas.	Engineer Maintenance of Way, C. R. I. & P. Ry.
BOEHME, ADOLPH J., 1901, M. E. Sharpsville, Pa.	With Shenango Furnace Co.
BOMESBERGER, W. N., 1903, E. M. Byesville, Ohio.	With Willes Creek Coal Co.
BONE, E. P., 1905, E. E. Walnut Hills, Cincinnati, O.	U. S. Inspector of Ohio River Improvement.
BOOTHMAN, DALE R., 1903, M. E. Mingo Junction, Ohio.	With Carnegie Steel Co.
BOSTATER, H. L., 1904, E. E. Chicago, Ill.	With the Western Electric Co. Telephone Engineering.
BOSTWICK, OLIVER N., 1902, C. E. Mt. Sterling, Ohio.	Farmer and Civil Engineer.
BOTT, GEORGE R., 1901, M. E. Indianapolis, Ind.	Engineer in charge of Automobile Production, Nordyke & Marmon Co.
BOWDEN, HARRY W., 1900, C. E. Mt. Vernon, Ohio.	Draftsman, Mt. Vernon Bridge Company.
BOWER, JEROME G., 1897, M. E. Chicago, Ill.	Sales Agent, Pressed Steel Car Company.
BRADFORD, JOSEPH N., 1883, M. E. Columbus, Ohio.	Professor of Architecture, Ohio State University.
BRANNON, T. H., 1903, C. E. Columbus, Ohio.	Asst. City Engineer.
BRASHEAR, CHARLES S., 1906, C. E. Columbus, Ohio.	With Kinnear Gager Mfg. Co.
BRASHEAR, E. R., 1903, C. E. Mt. Vernon, Ohio.	Draftsman, Mt. Vernon Bridge Works.
BREDBECK, WALTER B., 1906, C. E. Logansport, Ind.	With Pennsylvania Lines.
BRIDGMAN, B. L., 1904, C. E. Watertown, N. Y.	With New York Central Lines.
BRINDLE, TRACEY, 1906, C. E. Sandusky, Ohio.	In U. S. Engineer's Office.
BRITTON, GUY, 1904, C. E. Columbus, Ohio.	City Engineer's Office.
BRITTON, LLOYD C., 1902, C. E. Miami, Fla.	Asst. Engineer, Florida East Coast Ry.
BROOKS, HERBERT B., 1903, E. E. Washington, D. C.	Asst. Physicist Bureau of Standards.
BROPHY, JAMES F., 1899, E. M. Frostburg, Md.	
BROWN, FRED. W., 1888, E. M. Portland, Col.	Chemist, The Portland Cement Co.
BROWN, JOHN Q., 1898, M. E. Oakland, Cal.	Asst. General Manager and Engineer, Oakland Transit Co., and San Francisco, Oakland & St. Jose R. R.

Brown, Newton H., 1893, E. E. College Station, Tex.	Professor of Physics and Electrical Engineering, A. & M. College, Texas.
Brumley, Daniel J., 1895, C. E. Chicago, Ill.	Prin. Asst. Engineer, Illinois Central R. R.
Bruning, Henry D., 1896, C. E. Columbus, Ohio.	Manager National Engineering Company.
Buchenberg, A. E., 1900, E. E. Sandusky, Ohio.	Chief Electrical Engineer, Warren Electric Mfg. Co.
Buckman, A. L., 1897, E. E. Toledo, Ohio.	Superintendent of Equipment, Toledo Home Telephone Co.
Burnham, L. H., 1905, E. E. Pittsfield, Mass.	With Stanley Electric Co.
Burns, James F., 1891, C. E. Elizabethtown, Ky.	Engineer, Louisville & Nashville R. R.
Burrell, Glenn S., 1904, C. E. Mt. Vernon, Ohio.	In Mt. Vernon Bridge Works.
Bygate, Harry G., 1899, M. E. McKeesport, Pa.	With Monongahela Furnaces and Steel Works of National Tube Co.

C

Calkins, George H., 1895, E. E. New Haven, Conn.	Manager of New Haven Office of General Electric Co.
Cameron, Harry E., 1901, C. E. Wilkinsburg, Pa.	In Designing and Estimating Dept., McClintic Marshall Construction Co.
Cameron, Gaylor M., 1904, E. E. Cleveland, Ohio.	In Engineering Dept., Cleveland Electric Ry. Co.
Capron, M. F., 1888, M. E.	
Carr, Hugh Stanley, 1896, E. E. West Duluth, Minn.	Chief Engineer, American Carbolite Co.
Carroll, Patrick H., 1894, E. M. Herrin, Ill.	Superintendent, Big Muddy Coal & Iron Co.
Carson, Samuel K., 1895, E. E. Iloila, P. I.	Chief Surgeon, Philippines.
Cartzdafner, R. E., 1903, M. E. Columbus, Ohio.	Kilburn-Jacobs Co., Railway Construction.
Case, Lewis B., 1906, B. Sc. (Chem.) West Carrolton, Ohio.	Chemist, Friend Paper Co.
Cavanaugh, A. F., 1900, M. E. East Pittsburg, Pa.	With W. E. & M. Co.
Cavin, Frank T., 1902, E. E. Schenectady, N. Y.	Testing Dept., General Electric Co.
Cellarius, Fred. J., 1888, C. E. Dayton, Ohio.	Assistant City Engineer.
Chaffin, W. W., 1904, C. E. Columbus, Ohio.	Assistant on Engineer Corps, Indianapolis Div. Pa. Lines.
Chambers, Wm. R., 1904, M. E. Lynn, Mass.	In Testing Dept., General Electric Co.
Chappell, Walter E., 1898, E. E. Trafford Pk., Manchester, Eng.	With the British Westinghouse Electric Co. Ltd.

Chubb, C. St. J. Jr., 1904, C. E. (Arch.) Philadelphia, Pa.	Post-Graduate in Architecture, University of Pennsylvania.
Chubb, Joseph H., 1904, C. E. Columbus, Ohio.	
Chubb, L. W., 1905, E. E. East Pittsburg, Pa.	With Westinghouse E. & M. Company.
Cilley, Raymond, 1896, M. E. Brooklyn, N. Y.	Draftsman, Graham Fox Motor Co.
Clark, Thomas W,. 1904, E. M., (Cer.) Roseville, Ohio.	With the Ohio Pressed Brick Co.
Clarke, C. J., 1899, C. E. Columbus, Ohio.	Draftsman, City Engineer's Office.
Clarke, James U., 1902, E. E. Lancaster, Ohio.	Supt. Lancaster Traction & Power Co.
Coddington, E. F., 1896, C. E., 1897, M. Sc.; 1902, Ph. D. (Berlin.) Columbus, Ohio.	Asst. Professor of Mechanics, Ohio State University.
Coe, Elmer R., 1906, E. E. 706 Coal St., Wilkinsburg, Pa.	Asst. to Electrical Engineer, Union Switch and Signal Co.
Cole, George N., 1891, E. E. 277 Broadway, N. Y. City.	Mfg. Cross, Horizontal Folding and other Warehouse Doors.
Collins, Curtis, 1895, E. E. Columbus, Ohio.	Asst. Supt. of Columbus Railway and Light Co.
Conley, Clyde G., 1902, C. E. Mt. Vernon, Ohio.	Draughtsman, Mt. Vernon Bridge Co.
Connell, Wm. A., 1886, E. M. Kansas City, Mo.	
Conrad, Herman W., 1905, M. E. Milwaukee, Wis.	Special Apprentice, with Allis-Chalmers Co.
Conrad, Louis Verne, 1902, C. E. Pittsburg, Pa.	Asst. on Engineers' Corps, P., C. C. & St. L. R. R.
Conway, Hugh L., 1896, C. E. Cincinnati, Ohio.	Assistant City Engineer.
Cook, Spencer N., 1903, E. M. Des Moines, Iowa.	Superintendent, Smith-Lowe Coal Co.
Cooper, S. D., 1905, E. E. Cleveland, Ohio.	With Brown Hoist Co.
Cope, Albert N., 1897, E. E. Columbus, Ohio.	Chief Electrician, Columbus Public Service Co.
Cosley, Harvey H., 1901, C. E. Chicago, Ill.	Salesman, Cambria Steel Co.
Coulter, Leonard B., 1904, E. M. (Cer.) Columbus, Ohio.	With Prof. Edward Orton, Jr., Clay Testing and Mfg. Clay Specialties.
Covell, Vernon R., 1895, C. E. Pittsburg, Pa.	Deputy County Engineer, Allegheny Co.
Crable, Arthur, 1901, C. E. Huntington, Ind.	Division Engineer, Chicago & Erie Ry. Co.

Craft, F. M., 1905, E. E. Chicago, Ill.	Telephone Engineer, Western Electric Co.
Crocker, T. D., 1904, E. E. Milwaukee, Wis.	With Electric Ry. & Light Co.
Crooks, Thomas E., 1904, M. E. Lynn, Mass.	In Testing Dept., General Electric Co.
Croy, Harold L., 1906, M. E. 9501 Cedar Ave., Cleveland, O.	Draftsman, Peerless Motor Car Co.
Cunningham, E. W., 1894, C. E. Ambridge, Pa.	With American Bridge Co.
Cunningham, R. H., 1905, M. E. Cleveland, Ohio.	Salesman for The Ingersoll-Rand Co.
Curran, Michael F., 1905, C. E. New Orleans, La.	Asst. on Eng. Corps, Illinois Central R. R.
Curtis, Leigh G., 1899, C. E. Chicago, Ill.	Asst. Supt., B. & O. R. R.

D

Damron, Carson W., 1897, M. E. Pittsburg, Pa.	Asst. Engineer, Bollinger Andrews Construction Co.
Dann, Walter M., 1902, E. E. East Pittsburg, Pa.	With Westinghouse Electric & Manufacturing Co.
Davis, Charles W., 1894, E. M. Cleveland, Ohio.	Investments.
Davis, Oscar Allen, 1897, E. E. Alliance, Ohio.	Mechanical Engineer, Reeves Bros. Co.
Deahl, Walter S., 1896, C. E. Pittsburg, Pa.	Draftsman, Pittsburg Bridge Co.
DeLoffre, Andre, 1896, E. E. London, E. C., England.	Electrical Engineer for General Electric Co. of America.
Denny, Chas. W., 1901, E. E. 220 W. 29th, New York, N. Y.	In Experimental Dept., Cooper Hewitt Electric Co.
DeWolf, R. D., 1901, E. E. Pittsburg, Pa.	Electric Engineer, Westinghouse Electric & Manufacturing Co.
Diemer, Hugo, 1896, E. E. Indianapolis, Ind.	Consulting Engineer.
Dill, Raymond, 1901, E. E. Norwood, Ohio.	Sales Dept., Bullock Works, Allis-Chalmers Co.
Donham, M. D., 1896, M. E. Pittsburg, Pa.	Supt. of Agents, Nat. Life Ins. Co., of Vermont.
Dorsey, Walter A., 1904, M. E. Lynn, Mass.	In Testing Dept., General Electric Co.
Doty, Oliver P., Jr., 1904, E. M. Hanging Rock, Ohio.	Engineer.
Drummond, Wm. G., 1900, M. E. Buffalo, N. Y.	Mechanical Engineer.
Dun, John J., 1883, E. M. Columbus, Ohio.	Consulting Engineer.
Dunlap, Robert R., 1900, E. E. Columbus, Ohio.	Electrical Engineer, Jeffrey Manufacturing Co.

DUNLAP, T. C., 1895, E. E. Columbus, Ohio.	Vice President and Manager Columbus Pneumatic Tool Co.
DUNNICK, EDWARD, 1897, C. E. Cincinnati, Ohio.	With Brackett Bridge Co.
DUPUY, B. F., 1904, C. E. Clio, Cal.	Draftsman, Western Pacific Railway.
DURBIN, WILLIAM H., 1906, C. E. Sandusky, Ohio.	In City Engineer's Office.
DYCHE, HOWARD E., 1906, E. E. Cincinnati, Ohio.	Student Apprentice, Allis-Chalmers Co.

E

EAGLE, WILLIAM H., 1906, C. E. Columbus, Ohio.	In City Engineer's Office.
EMBREY, MORROW L., 1906, M. E. Milwaukee, Wis.	With Allis-Chalmers Co.
EMSWILER, JOHN E., 1903, M. E. Schenectady, N. Y.	In Turbine Testing Dept., General Electric Co.
ERSKINE, JAMES H., 1886, E. M., M. D. Albany, Ore.	Physician and Surgeon.
ESTEP, FRANK L., 1898, E. E. Detroit, Mich.	Second Asst. Supt., Detroit Copper & Brass Rolling Mills
EVANS, PETER P., 1892, C. E. Osborn Bldg., Cleveland, Ohio.	Contracting Engineer.
EYSENBACH, E. E., 1896, E. M. Binghamton, N. Y.	Gen'l Mgr. Binghamton Gas Company.

F

FEIGHT, EDWARD R., 1904, M. E. Wilkinsburg, Pa.	Turbine Dept., Westinghouse Machine Company.
FEIGHT, RUSSELL S., 1890, E. E. Pittsburg, Pa.	Head of Industrial Division, Engineering Dept., Westinghouse Electric & Mfg. Co.
FELGER, THEODORE H., 1906, M. E. Milwaukee, Wis.	With Allis-Chalmers Co.
FERGUS, GUY C., 1898, E. E. Zanesville, Ohio.	Partner, Zanesville Electric Company.
FICKES, WALTER M., 1900, E. M. Carnegie, Pa.	Brick Manufacturer.
FIELDNER, ARNO C., 1906, B. Sc. (Chem.) 185 W. 9th Ave., St. Louis, Mo.	With U. S. Geological Survey.
FISH, FRED. ALAN, 1898, E. E. Ames, Iowa.	Associate Professor of Electrical Engineering, Iowa State College.
FLOTO, JULIUS, 1889, E. M. Chicago, Ill.	Agent, Brown-Keetcham Iron Works of Indianapolis.
FLOWERS, DEAN W., 1905, E. M. Bennington, N. Y.	With the Bennington Gas Co.

Flynn, Harry F., 1892, C. E. Manila, P. I.	Chief Surveyor, Bureau of Public Lands.
Ford, Nile Otis, E. M., 1897, A. B.; 1900, M. S. San Francisco, Cal.	Asst. Manager, Herring-Hall-Marvin Safe Co.
Forester, Charles T., 1906, M. E. Denver, Colo.	With Denver Gas & Electric Co.
Foster, Frank M., 1894, E. E. Cincinnati, Ohio.	Secretary and Treasurer, American Valve and Meter Company.
Foster, Vause, 1903, E. M. Chillicothe, Ohio.	Deputy Co. Surveyor.
Fowler, Harry R., 1894, E. E. Toledo, Ohio.	Electrical Engineer and Contractor.
Fox, Arthur L., 1906, M. E. New York City.	With New York Telephone Co.
Fox, John Herbert, 1897, M. E. Cleveland, Ohio.	Consulting Engineer.
Frame, Rollo S., 1901, C. E. Pittsburg, Pa.	Asst. on Engineer Corps, Penn. Lines.
Frankenberg, G. T., 1902, M. E. Columbus, Ohio.	Mechanical Engineer, The Ralston Steel Car Co.
Frankenberg, J. T., 1899, E. E. Providence, R. I.	Chief Engineer Providence Telephone Co.
Fravel, George B., 1888, M. E. Chicago. Ill.	Master Mechanic, Chicago Terminal Division, Penn. Lines.
Frayer, Lee A., 1896, M. E. Columbus, Ohio.	With Columbus Machine Co.
Frechtling, Arthur, 1901, M. E. Beloit, Wis.	With Fairbanks-Morse Co.
Freeman, S. S., 1898, E. M. Parrysville, Pa.	Blast Furnace Manager, Carbon Iron & Steel Co.
French, Thomas E., 1895, M. E. Columbus, Ohio.	Professor of Engineering Drawing, Ohio State Uniiversity.
Frost, George W., 1900, M. E. Dayton, Ohio.	With the Dayton Electric Co.
Fuller, Charles W., 1904, E. M. Copper Mountain, Alaska.	Metallurgist.

G

Gallen, William F., 1897, M. E. Columbus, Ohio.	Foreman of Drafting Room, Case Manufacturing Co.
Gamper, Herman, 1899, M. E. Xenia, Ohio.	Supt. Engineering Dept., O. S. & S. O. Home.
Garber, John M., 1897, C. E. Wheeling, W. Va.	Chief Draftsman, W. Va. Bridge & Construction Co.
Gault, Paul M., 1906, E. E. 116 New York, St., Pittsburg, Pa.	Signal Dept., Penna Ry.
Gee, Eugene C., 1897, E. E. Manila, P. I.	Gen. Manager, Philippine Island Tel. and Tel. Co,

Gehrkens, E. F., 1894, E. E. Schenectady, N. Y.	With General Electric Co.
Gerwick, Benjamin C., 1906, C.E. Clairville, Plumas Co., Cal.	With Western Pacific R. R.
Gibson, John C., 1906, E. M. Las Esperanzas, Coah, Mexico.	Mine Engineer.
Given, James Byron, 1896, E. E. Chicago, Ill.	In Telephone Dept., Western Electric Co.
Glass, Robert G., 1906, C. E. Wheeling, W. Va.	With B. & O. R. R.
Glunt, Omer M., 1906, E. E. 593 W. Monroe St., Chicago, Ill.	Student, Telephone Dept., Western Electric Co.
Goddard, Loring H., 1892, C. E. Wooster, Ohio.	Farmer.
Goodell, Ralph S., 1892, C. E. Mt. Vernon, Ohio.	Principal Assistant Engineer, Mt. Vernon Bridge Co.
Gould, Wm. S., 1904, M. E. Lynn, Mass.	In Steam Turbine Testing Dept., Gen. Electric Co.
Graham, Emery E., 1898, E. E. Cleveland, Ohio.	Draftsman, Wellman-Seaver-Morgan Engineering Co.
Grate, Charles A., 1898, M. E. Cleveland, Ohio.	With Interstate Engineering Company.
Green, Jerome J., 1892, E. E. Notre Dame, Ind.	Professor of Physics and Electrical Engineering, University of Notre Dame.
Green, Joseph F., 1890, E. E. Moline, Ill.	Electrical Engineer, Moline Elec. Elev. Co.
Gregory, Hiram D., 1880, E. M. Covington, Ky.	Attorney-at-Law.
Griffin, Mark H., 1897, E. E. Spitzer Bldg., Toledo, Ohio.	Real Estate Agent.
Groves, John W., 1898, C. E. Carbon, W. Va.	Superintendent Republic Coal Company.
Guiss, Charles A., 1905, C. E. Bucyrus, Ohio.	City Engineer.
Gwynne, Josiah W., 1904, E. E. Montreal, Can.	Sales Dept., Canadian Westinghouse Co.

H

Haas, Frank, 1895, C. E.; 1896, E. M. Fairmount, W. Va.	Chemist, Fairmount Coal Co.
Hackney, W. W., 1905, M. E. Fort Wayne, Ind.	With Western Car Construction Co.
Hagemeyer, Earl P., 1905, C. E. Cincinnati, Ohio.	Asst. to Supt., Baldwin Piano Co.
Hale, Frederick J., 1898, M. E.; 1900, M. Sc. East Pittsburg, Pa.	Asst. Foreman, Westinghouse Machine Co., Gas Engine Department.
Hall, Charles R., 1906, M. E. Columbus, Ohio.	With Columbus Structural Steel Co.

HALL, HARRY R., 1889, E. M. Sault Ste. Marie, Ont., Can.	Supt. Blast Furnaces, The Lake Superior Power Co.
HALLSTEAD, ROBERT H., 1906, C. E. Grand Central Station, New York City.	With New York Central R. R.
HAMILTON, ROSS E., 1903, C. E. Roanoke, Va.	Transitman, Deepwater Ry.
HAMMOND, C. E., 1905, E. E. 4731 S. Atlanta St., Pittsburg, Pa.	With National Tube Co.
HAMMOND, JOHN M., 1902, C. E. Dunkirk, N. Y.	Assistant in Eng. Dept., L. S. & M. S. Ry.
HANCE, HARRY T., 1901, B. Sc. (Chem.) Columbus, Ohio.	Sec.-Treas. of Hance Casting Co.
HANGE, FREDERICK I., 1906, E. E. Chicago, Ill.	With Western Electric Co.
HAPGOOD, EUGENE P., 1902, B. Sc. Salt Lake City, Utah.	Assistant, Maintenance of Way Dept., S. P. L. A. & S. L. R. R.
HARDY, PAUL, 1904, E. M. Holden, W. Va.	Supt., U. S. Coal & Oil Co.
HARKINS, ROBERT R., 1900, M. E. Pittsburg, Pa.	Manager Pittsburg Office, Atlas Engine Co.
HARRINGTON, A. L., 1905, E. E. Pittsburg, Pa.	With General Electric Co.
HARRISON, WM. H., 1885, C. E. Columbus, Ohio.	Railway Engineer.
HARROP, CARL B., 1902, E. M. Columbus, Ohio.	Secretary, Scott Kiln Drying Company.
HARTWELL, ARTHUR, 1888, M. E. Detroit, Mich.	Manufacturer.
HARTWICK, LOUIS M., 1897, M. E. Pueblo, Col.	Master Mechanic, Blast Furnace, C. F. & I. Co.
HARVEY, CLARKE K., 1906, C. E. 602 Times Bldg., Pittsburg, Pa.	Civil Engineer.
HASSLER, ROBERT H., 1892, E. E. Indianapolis, Ind.	Engineer, International Motor Car Co.
HAWTHORNE, CARL H., 1905, C. E. Kansas City, Mo.	In Railroad Engineering Work.
HAYMAN, WM. C., 1906, E. E. Schenectady, N. Y.	Engineer, Wire & Cable Dept., General Electric Co.
HAYWARD, GEORGE E., 1893, C. E. Bronson, Mich.	Secy.-Treas., American Truss Post Co.
HAZLETT, ROBERT, 1887, C. E. Wheeling, W. Va.	Consulting Civil Engineer.
HEBBLE, CHARLES R., 1896, E. E. Cincinnati, Ohio.	Special Agent, Penn Mutual Life Insurance Co.
HELVEY, GEORGE S., 1903, M. E. Milwaukee, Wis.	With Allis-Chalmers Co.
HENDERSON, A. A., 1898, C. E. Pittsburg, Pa.	Civil Engineer.
HENRIETTA, CHAS. M., 1896, E. M. Calgary, N. W. Territory, Can.	In Mining and Metallurgical Dept., Canadian Pacific R. R.

Hepner, C. R., 1905, E. E. Cleveland, Ohio.	With Lincoln Electric Co.
Hertner, John H., 1899, E. E. Cleveland, Ohio.	Of Hertner Electric Co.
Hewitt, S. R., 1898, E. E. Columbus, Ohio.	With Kinnear Mfg. Co.
Hill, Cortland L., 1903, C. E. Columbus, Ohio.	Assistant in City Engineer's Office.
Hine, Lucius A., 1888, E. M. Chicago, Ill.	President and Treasurer, Hine-Watt Manufacturing Co.
Hipple, John M., 1893, E. E. Pittsburg, Pa.	Engineer, Westinghouse Electric & Mfg. Co.
Hirsch, Gustav, 1897, E. E. Lima, Ohio.	Chief Engineer and Vice President, Ideal Construction Co.
Hirst, Harry, 1903, E. M. Dennison, Ohio.	Superintendent, Dennison Mining Co.
Hitch, James F., 1902, C. E. Williamson, W. Va.	Engineer, Ohio & Big Sandy Coal Co.
Hite, Florence E., 1904, C. E. Chicago, Ill.	Draftsman with S. M. Cromen, Architect.
Hobbs, Caleb, 1905, E. E. Schenectady, N. Y.	Foreman of Government Electric Test, with General Electric Co.
Holbrook, George F., 1902, E. M. Hollywood, Cal.	Surveyor, with City Engineer.
Holl, Alfred T., 1906, C. E. 703 N. Clarendon, Ave.,, Canton, Ohio.	With J. H. Holl, McKinley National Memorial.
Holloway, T. W., 1904, M. E. Scranton, Pa.	With International Correspondence Schools.
Homan, Frank, 1895, C. E. Carbon, W. Va.	Superintendent Republic Coal Company.
Hood, Willard J., 1904, M. E. Huntington, W. Va.	In Motive Power Dept., C. & O. R. R.
Hope, H. L., 1905, E. E. Chicago, Ill.	Telephone Engineering.
Hopkins, Lloyd C., 1905, M. E. St. Louis, Mo.	Chemist with U. S. Geological Survey, Fuel Testing Plant.
Howald, Ferd., 1878, B. Sc., 1881, E. M. Columbus, O.	Coal Operator.
Howard, Howard R., 1906, E. M.	
Howe, Roy E., 1904, C. E. Roosevelt, Idaho.	Assayer.
Howells, E. S., 1884, E. M. Birmingham, Ala.	President, Howells Mining Co.
Howells, T. J., 1897, E. M. Bluefield, W. Va.	Chemist in Pocahontas Coal Field for National Steel Co.
Huddleson, F. N., 1902, E. M. Salt Lake City, Utah.	In Maintenance of Way Dept., S. P., L. A. & S. L. Ry.
Hull, Walter A., 1902, E. M. (Cer.) Drummond, Pa.	General Manager, Shawmut Clay Mfg. Co.

Humphrey, H. P., 1904, E. M. (Cer.) Bradford, Pa.	Vice President Northeastern Terra Cotta Co.
Hunt, Wm. F., 1887, M. E.; 1895, LL. B.; 1896, LL. M. (Univ. of Minn.), St. Paul, Minn.	Attorney-at-Law.
Hunter, James W., 1904, C. E. Evansville, Ill.	Division Engr., Evansville & Terre Haute R. R.
Hunter, Madone C., 1900, E. E. St. Joseph, Mo.	Consulting Engineer.
Huntington, A., 1899, M. E. Sioux Falls, S. Dak.	President of Cascade Milling Co.
Hurlburt, Charles C., 1906, C.E. Columbus, Ohio.	Engineering Corps, H. V. R. R.
Hyle, Charles A., 1896, E. E. Minneapolis, Minn.	Observer, U. S. Weather Bureau.

I

Iancu, Joseph, 1905, E. E. Schenectady, N. Y.	With General Electric Co.
Ireland, Guy L., 1895, M. E.	
Irvin, Chadwick H., 1897, M. E. Great Falls, Mont.	With Boston and Montana Smelter.

J

Jacobi, Jacob A., 1905, C. E.	Asst. on Eng. Corps, Illinois Central R. R.
Jaynes, Gaylor C., 1906, E. M. Leopold, New Mexico.	Chief Engineer, Burr Mountain Copper Co.
Jeannot, Frederick C., 1905, M.E. Cleveland, Ohio.	With Osborn Engineering Co.
Jenkins, William G., 1893, C. E. Bellefontaine, Ohio.	Draftsman, The Bellefontaine Bridge & Iron Co.
Jenkins, Willis H., 1894, C. E. Sheridanville, Pa.	Transitman, Penn. Lines, West of Pittsburg.
Jennings, Levi E., 1897, E. E. Dayton, Ohio.	With R. E. Kline, Consulting Engineer.
Johnson, Chas. W., 1896, E. E. Montreal, Can.	General Superintendent Allis-Chalmers Bullock Co., Ltd.
Johnson, Earl S., 1900, E. E. Schenectady, N. Y.	In Testing Department, General Electric Co.
Johnson, Walter A., 1902, M. E. Columbus, Ohio.	Foreman Motive Power Dept., Penna. Lines.
Johnston, George E., 1892, C. E. Louisville, Ky.	Roadmaster and Assistant Engineer, L. & N. R. R.
Johnston, H. L., 1892, E. E. Troy, Ohio.	Manager Hobart Electric Mfg. Co.
Jones, Arthur J., 1898, E. E. Niagara Falls, N. Y.	Foreman, with Niagara Falls Power Co.

Jones, Grandville R., 1904, C. E.	
Jones, Houston, 1895, E. E. 604 Burlington Bldg., St. Louis, Mo.	Consulting Engineer.
Jones, Pearl N., 1892, E. E. Wilkinsburg, Pa.	Chief Engineer, Pittsburg Ry. Company.
Jones, Smiley, 1894, E. M. Prescott, Arizona.	
Judd, Horace, 1897 M. E.; 1899, M. Sc. Columbus, Ohio.	Assistant Professor in Experimental Engineering, Ohio State University.
Judson, Walter R., 1903, M. E. Mapini, Durango, Mexico.	With Compania Minera de Penoles.

K

Kalb, Warren C., 1904, E. E. Columbus, Ohio.	Mechanical Engineering, Columbus Pneumatic Tool Co.
Kanmacher, S. H., 1900, E. E. Schenectady, N. Y.	Engineer, Power and Mining Eng. Dept., Gen. Electric Co.
Keating, H. T., 1902, B. Sc. (Chem.) Columbus, Ohio.	Insurance.
Keffer, Frederick, 1892, E. M. Greenwood, British Col.	General Manager, The British Columbia Copper Co., Ltd.
Kemmler, E. A., 1888 C. E. Columbus, Ohio.	Second Assistant City Engineer.
Kempton, W. H., 1905, E. E. East Pittsburg, Pa.	With Westinghouse Eng. & Mfg. Co.
Kern, William F., 1902, B. Sc. (Chem.) Manhattan, Nev.	Chemist and Mining Engineer.
Kerr, Samuel T., 1894, E. E. Martins Ferry, Ohio.	Supt., Municipal Electric Light Plant.
Kester, Frederick E., 1895, E. E.; 1905, Ph. D. (Cornell). Columbus, Ohio.	Assistant Professor of Physics, Ohio State University.
Kettering, Chas. F., 1904, E. E. Dayton, Ohio.	Chief of Electrical Invention Dept., National Cash Register Co.
Kettler, Frank C., 1901, C. E. Chicago, Ill.	In North Works, Illinois Steel Company.
Kiesewetter, L. F., 1891, C. E.; 1892, A. B., and 1893, A. M., (Harv.). Columbus, Ohio.	Cashier, The Ohio National Bank.
King, Herbert S., 1901, C. E. Springfield, W. Va.	Engineer of Construction, Springfield Colliery Co.
King, Roy S., 1892, M. E. Columbus, Ohio.	Assistant Professor of Experimental Engineering, Ohio State University.
Klie, Walter, 1903, M. E. Columbus, Ohio.	With Klie Plumbing Co.

KLINE, CHARLES H., 1897, E. E... Dayton, Ohio.	Civil Engineering, with R. E. Kline, Consulting Engineer.
KNECHT, ARTHUR E., 1898, M. E. Cincinnati, Ohio.	Mechanical Engineer, Cincinnati Screw and Tap Co.
KNIGHT, WM. ABNER, 1900, M. E. Columbus, Ohio.	Assistant Professor of Machine-Shop Practice, Ohio State University.
KNOPF, C. S., 1905, E. E......... Columbus, Ohio.	Machinist, Elec. Eng. Dept., Ohio State University.
KNOX, FRANK S., JR., 1900, E. M. Buchtel, Ohio.	Chief Engineer, Pittsburg Coal Co.
KRUMM, LOUIS R., 1898, E. E..... Columbus, Ohio.	Electrical Engineer, War Dept.
KRUMM, THOMAS Z., 1902, C. E. Mandan, N. D.	Surveyor, with Northern Pacific R. R.
KRYDER, ERNEST R., 1906, C. E... Logansport, Ind.	Civil Engineer.
KUENZEL, OSCAR, 1905, M. E..... Dennison, Ohio.	Special Apprentice in Penn. R. R. Shops.
KUHN, VALLIE H., 1896, E. E.... Etna, Ohio.	Machinist.
KUNKLE, FRED. R., 1903, E. E.... Pittsburg, Pa.	Electrical Engineer, Westinghouse Elec. & Mfg. Co.

L

LAKE, LEWIS J., 1905............ Mt. Vernon, Ohio.	With Mt. Vernon Bridge Co.
LAMB, WHITNEY E., 1900, E. E.. Commercial Pt., Ohio.	Farmer and Stockman.
LAMME, BENJAMIN G., 1888, M.E. Pittsburg, Pa.	Chief Engineer, Westinghouse Electrical & Mfg. Co.
LAMME, BERTHA A., (Mrs. R. S. Feicht), 1893, E. E. 1115 Portland St., Pittsburg, Pa.	
LANDAHL, EUGENE E., 1905, E. M. Columbus, Ohio.	With The Jeffrey Mfg. Co.
LARGE, JOSEPH H., 1890, C. E..... Toledo, Ohio.	Draftsman, Massillon Bridge Company.
LAURENCENA MIGUEL J., 1906, E. E. Parana, Argentine, Rep.	Electrical Engineer.
LAYLIN, DAVID T., 1905, M. E.... Hawthorne, Ill.	With Western Electric Co.
LAYMAN, FRANK E., 1905........ Saylorsburg, Pa.	With Blue Ridge Enamel Brick Co.
LEE, CORLISS EGDAR, 1900, E. E.. Schenectady, N. Y.	With General Electric Co.
LEE, LOUIS R., 1906, E. E........ 61 W. 3d Ave., Columbus, Ohio.	Assistant to M. S. Hopkins.
LEE, ROBERT M., 1897, M. E...... Washington, D. C.	Draftsman, Ordnance Dept., U. S. Army.

Leibold, Carl P., 1904, E. E. Mansfield, Ohio.	With Ohio Brass Co.
Lesh, John Howard, 1901, M. E. Bedford, Ohio.	Chief Draftsman, Interstate Engineering Co.
Levering, O. D., 1893, M. E. Columbus, Ohio.	Manufacturer Wall Ties.
Lincoln, Paul M., 1892, E. E. Pittsburg, Pa.	Head of Power Div., Engineering Dept., Westinghouse Electric & Mfg. Co.
Linebaugh, Jesse J., 1899, E. E. Schenectady, N. Y.	Electrical Engineer, Railway Engineering Dept., Gen. Elec. Co.
Linville, C. P., 1900, B. Sc. (Chem.) 1902, A. M. State College, Pa.	Instructor in Metallurgy, Pennsylvania State College.
Logan, L. L., 1896. E, M. Robertsdale, Pa.	General Supt., Rockhill Iron & Coal Co.
Long, George G., 1903, E. M. Gary, McDowell Co., W. Va.	With Engineering Dept., U. S. Coal & Coke Co.
Lott, Charles M., 1895, E. E. Hicksville, Ohio.	Proprietor and Superintendent of Hicksville Electric Light Plant.
Lovejoy, Ellis, 1885, E. E. Columbus, Ohio.	Consulting Engineer.
Lucas, Harry N., 1906, E. E. 926 South Ave., Wilkinsburg, Pa.	Student Apprentice, W. E. & M. Co.
Lyon, Arthur H., 1900, M. E. Bucyrus, Ohio.	Works Manager, New York Blower Co.

M

McAllen, Wm. J., 1894, C. E. Chicago, Ill.	Civil Engineer, Structural Department, North Works, Illinois Steel Co.
McCarter, R. D., Jr., 1895, E. E. London, E. C., England.	Manager and Engineer, Bath Electric Tramway, Ltd.
*McComb, Hoyt S., 1904, E. M.	Died Feb. 26, 1907.
McCormick, J. H., 1880, M. E. 1354 Fair Ave., Columbus, O.	Mechanical Engineer.
McCormick, W. F., 1896, M. E. Chicago, Ill.	With Illinois Steel Co.
McFarland, H. M., 1902, E. M. Ensley, Ala.	Division Engineer.
McGarey, Leo S., 1904, E. E. Columbus, Ohio.	With Scioto Valley Traction Company.
McGarraugh, Robert S., 1906, Columbus, Ohio.	
McGrew, John A., 1895, C. E. Columbus, Ohio.	Pres. Nat. Eng. Co.
McGuffey, F. H., 1894, E. E. Conover, Ohio.	Clerk in Railway Mail Service.

McINTIRE, ALFRED H., 1898, E. E.; 1900, M. E. Pittsburg, Pa.	Editor, The Electric Journal.
McINTOSH, ROSCOE E., 1902, E. E. Los Angeles, Cal.	Electric Engineer, with McIntosh Elec. Co.
McKEON, ROBERT D., 1902, C. E. Logansport, Ind.	Assistant on Engineers' Corps, Logansport Div., P., C., C. & St. L. Ry.
McMASTER, CARLOS L., 1905, C. E. Champaign, Ill.	Instructor in Drawing, Univ. of Illinois.
McNARY, G. B., JR., 1896, E. E. Toledo, Ohio.	Purchasing Agent, F. Bissell Company.
MANLEY, RUSH E., 1894, E. E. Columbus, Ohio.	Chief Inspector, Central Union Telephone Co.
MARCKWORTH, O. S., 1901, B. Sc. (Chem.) Columbus, Ohio.	Analytical and Consulting Chemist.
MARKER, JAMES R., 1904, C. E. Greenville, Ohio.	County Surveyor, Darke Co.
MARQUARDT, FRANK F., 1896, C.E. Sharon, Pa.	Superintendent, The Sharon Coke Co.
MARQUARDT, WILLIAM B., 1905, E. M. Sharon, Pa.	Supt., F. H. Buhl Club.
MARSHALL, CHAS. H., 1903, M. E. Fort Wayne, Ind.	With Western Gas Construction Co.
MARSHALL, W. B., 1900, E. E.	
MARTIN, GEORGE, 1897, E. E. Elyria, Ohio.	Foreman Drafting, Electrical Dept., National Tube Co.
MARTIN, JOHN D., 1901, M. E. New Straitsville, Ohio.	Coal Operator.
MARTIN, PERCY, 1892, E. E. Coventry, England.	General Manager, Daimler Motor Co.
MARTIN, RAY M., 1904, M. E. Inglis, Fla.	Chief Engineer, Barker Chemical Co.
MARVIN, CHARLES F., 1883, M. E. Washington, D. C.	Professor of Meteorology, in Charge Instrument Division, U. S. Weather Bureau.
MASJOAN, JUAN, 1906, E. E. Parana, Argentine Rep.	Electrical Engineer.
MASTERS, GEORGE A., 1886, C. E. Topeka, Kas.	Assistant Bridge Engineer, A. T. & S. F. Ry. System.
MAURER, OSCAR V., 1906, E. E. 1824 79th St., N. E. Cleveland, Ohio.	With Cuyahoga Incandescent Lamp Co.
MEIKLEJOHN, ROBERT, 1904, M. E. Columbus, Ohio.	Instructor in Engineering Drawing, Ohio State Univ.
MELICK, CYRUS A., 1903, C. E. Norfolk, W. Va.	Draftsman, Tidewater R. R.
MELICK, NEAL A., 1900, C. E. Norfolk, W. Va.	Asst. Eng. Tidewater R. R.
MELLINGER, A. H., 1905, E. E. New York City.	With New York Telephone Co.

Menough, A. G., 1894, E. M..... Wellsville, Ohio.	Secretary and Treasurer, Menough Iron & Steel Fdry. Co.
Mercer, Frank E., 1896, E. M... San Francisco, Cal.	With Risdon Iron and Locomotive Works.
Mercer, Robert W., 1903, E. M.. Gary, McDowell Co., W. Va.	Computer, U. S. Coal & Coke Company.
Merrill, Ernest M., 1902, C. E.. Beckley, W. Va.	General Engineering.
Merrill, Ferrand S., 1905, C. E. Toledo, Ohio.	Draftsman, American Bridge Co.
Merrill, Ralph O., 1906, E. E.. 4122 Chester Ave., Philadelphia, Pa.	Inspector, Bell Telephone Co.
Mershon, Ralph D., 1890, M. E. 11 Pine St., New York City.	Consulting Engineer.
Metz, Ora F., 1905, E. E......... Cincinnati, Ohio.	Asst. Foreman Test. Dept., Bullock Electric Co.
Miller, Albert A., 1902, C. E.... Philadelphia, Pa.	Division Engineer, B. & O. R. R.
Miller, Frank Case, 1893, C. E. Sacramento, Cal.	Division Engineer, Sacramento Div., Southern Pacific Ry.
Miller, Henry F., 1889, M. E... 345 E. State St., Columbus, O.	Consulting Engineer.
Miller, Ralph C., 1901, C. E... Columbus, Ohio.	Engr. Indianapolis Div., Penna. Lines.
Minns, Raymond H., 1906, E. E. Pittsburg, Pa.	Student Apprentice, W. E. & M. Co.
Minor, Wells H., 1903, E. M... Box 124, Central City, Ky.	Mining Engineer, Central Coal & Iron Co.
Minton, LeRoy H., 1904, E. M... (Cer.) Perth Amboy, N. J.	Ceramic Chemist, Perth Amboy Terra Cotta Co.
Mooney, George L., 1903, E. E... Pittsburg, Pa.	With Westinghouse Elec. & Mfg. Co.
Morey Paul C., 1906, E. E...... Cincinnati, Ohio.	Student Apprentice, Allis-Chalmers Co.
Morlan, Wilbert, 1903, M. E... Milwaukee, Wis.	With Allis-Chalmers Co.
Morris, Clyde T., 1898, C. E..... Columbus, Ohio.	Associate Professor Civil Engineering, O. S. U.
Morris, Robert H., 1901, E. M... Masontown, Pa.	Supt. Roberts & Schaefer Co.
Morris, Willard B., 1903, M. E. Columbus, Ohio.	With C. E. Morris & Co., Structural Steel Works.
Morris, William B., 1902, M. E. Mt. Vernon, Ohio.	Draftsman, C. & G. Cooper Co.
Morrison, Robert O., 1893, C. E. Zanesville, Ohio.	Asst. Eng., M. of W., C. & M. V. R. R.
Morse, George H., 1906, E. M... Las Esperanzas, Coah, Mexico.	Mine Engineer.
Morton, George L., 1884, M. E... Washington, D. C.	Principal Examiner, Instruments of Precision, U. S. Patent Office.

Munn, Mortimer A., 1894, C. E. Baltimore, Mr.	Civil Engr., with the Roberts-Abbott Co.
Murphy, Joseph L., 1903, C. E. Floodwood, Ohio.	Mining Engineer, N. Y. Coal Company.
Myers, Albert B., 1900, E. M. Tepezala, Aguascalientes, Mex.	Superintendente, Minas Tepezalanas.
Myers, Ord, 1895, E. E. New York City.	Electrician, Metropolitan St. Railway Co.
Myers, Roy V., 1893, C. E. Knoxville, Tenn.	Civil and Mining Engineer.
Myers, Uriah H., 1887, E. M. Pittsburg, Pa	Printer and Stationer, Meyers & Shinkle.

N

Nagel, William G., 1895, M. E. Toledo, Ohio.	President and Manager, W. G. Nagel Electric Co.
Nauss, Ralph W., 1901, B. Sc. (Chem.)	
Needham, Harry S., 1900, M. E. Dennison, Ohio.	Assistant General Foreman, P., C., C. & St. L. R. R. Shops.
Nelson, Fred. B., 1905, C. E. 310 Ashband Blk., Chicago, Ill.	Hydraulic Engineer.
Nesbit, Chas. E., 1904, B. Sc. (Chem.) Wilkinsburg, Pa.	Chemist, Carnegie Steel Co.
Nesbitt, F. C., 1905, E. E. Columbus, Ohio.	Draftsman, Ralston Steel Car Co.
Newton, Samuel D., 1895, C. E. Knoxville, Tenn.	Civil Engineer, Southern Ry. Company.
Nichols, Harry B., 1903, C. E. Wheeling, W. Va.	Draftsman in U. S. Engineer's Office, Ohio River Improvement.
Nicholson, C. M., 1900, E. E. Cincinnati, Ohio.	Foreman on Testing and Constructing Depts., Bullock Elec. Mfg. Co.
Nidy, Herbert C., 1901, E. E. Cleveland, Ohio.	With Cleveland Electric Railway Co.
Nold, John H., 1900, E. M. Columbus, Ohio.	Mine Engineer, Assistant to F. A. Ray.
Nold, Frederick B., 1905, E. M. Arcade, N. Y.	With Hoover & Kinnear.
Nurian, Kerson, 1899, M. E. St. Louis, Mo.	With Engineering Dept., Missouri Pacific Ry.
Nye, Ralph D., 1903, E. E. Pittsburg, Pa.	In Power Dept., Westinghouse Elec. & Mfg. Co.

O

O'Brine, David, 1881, B. Sc., M. Sc.; 1882, E. M., D. Sc., M. D. Urbana, Ohio.	Physician and Surgeon.

Ogden, Ellsworth, 1905......... Shawnee, Ohio.	Asst. Supt., Ohio Mining & Mfg. Co.
Orndorf, Earl L., 1903, B. Sc. (Chem.) Cincinnati, Ohio.	Assistant Chemist, Proctor & Gamble Co.
Orton, Edward, Jr., 1884, E. M.. Columbus, Ohio.	Professor of Ceramics, Ohio State University.

P

Pabodie, Robert J., 1899, M. E... Watertown, N. Y.	Salesman Engineer, Watertown Engineering Co.
Palmer, Walter K., 1893, M. E. 718 Dwight Bldg., Kansas City, Mo.	Consulting Mechanical and Electrical Engineer.
Parrett, Benj. C., 1902, B. Sc. Chem.) Struthers, Ohio.	Chemist, Struthers Furnace Company.
Patch, Homer A., 1896, C. E.... Minneapolis, Minn.	Draftsman, Minneapolis Steel & Machinery Co.
Payne, Halbert E., 1887, M. E. New York City.	President, American Typewriter Co.
Pearl, Allen S., 1894, E. E...... Chicago, Ill.	Manager, Specialty Dept., Central Elec. Co., Chicago, Ill.
Peirce, John M., 1895, E. E..... Los Angeles, Cal.	With Home Telegraph & Telephone Co.
Pelton, Forrest B., 1904, E. E... Schenectady, N. Y.	In Testing Dept., General Electric Co.
Peppel, Samuel V., 1899, B. Sc. (Chem.) Columbus, Ohio.	Chemical Engineer.
Peters, William L., 1885, M. E. Riverside, Cal.	Horticulturist.
Petersen, John W., 1903, C. E. (Arch.) Pittsburg, Pa.	Inspector, Chief Engineer's Office, P., C., C. & St. L. Ry.
Pflueger, Edwin B., 1905, C. E. Cleveland, Ohio.	With the M. of W. Dept., Erie R. R. Co.
Pleukharp, C. V., 1885, M. E... La Crescenta, Cal.	Clergyman.
Pocock, Paul C., 1906, M. E..... Columbus, Ohio.	With Elah Terrell, Contractor and Engineer.
Polk, Walter C., 1895, C. E.... Birmingham, Ala.	Telephone Engineering and Construction.
Porterfield, John C., Jr., 1906, E. M.	
Postle Herman R., 1894, C. E.. South Pasadena, Cal.	Civil Engineer.
Poto, Frank B., 1901, B. Sc. (Chem.) , Sta. C, Columbus, Ohio.	Chemist, Carnegie Steel Co.
Powell, Charles S., 1893, E. E. 111 Broadway, N. Y. City.	General Agent, Westinghouse Electric & Mfg. Co.

POWELL, IVAN E., 1904, E. E. Rochester, N. Y.	Engineering Assistant, Rochester Ry. & Light Co.
PRATT, FRED. KELLOGG, 1900, C. E. Colorado Springs, Col.	Teacher of Mathematics, High School.

R

RAWSON, LEVI, 1899, C. E. Sistersville, W. Va.	Engineer, Carter Oil Co.
RAY, FRANK A., 1887, E. M. Columbus, O.	Professor of Mine Engineering, Ohio State University.
RAY, WILLIAM M., 1893, C. E. Cleveland, Ohio.	Asst. Eng. of Const., B. & O. R. R. Co.
RAYMOND, COLES A., 1894, C. E. Toledo, Ohio.	Asst. Engineer, American Bridge Co.
REED, G. NATHANIEL, 1903, M. E. Youngstown, Ohio.	Draftsman with The William Tod Co.
REED, ROBERT B., 1896, E. E. Akron, Ohio.	Electrical Contractor and Engineer.
REED, WILLIAM A., 1897, E. M. Telluride, Col.	Assistant Supt., Liberty Bell Gold Mining Co.
REIF, CHARLES C., 1906, M. E. Chicago, Ill.	With Western Electric Co.
RIBOT, ANTONIO Y C., 1904, E. E. San Juan, P. R.	Electrical Engineer.
RICE, HERBERT A., 1897, C. E. Lawrence, Kas.	Associate Professor of Civil Engineering, Univ. of Kas.
RICE, RAY H., 1904, C. E. Norfolk, Va.	Construction Work, Tidewater Railway.
RIDDILE, JOHN S., 1904, E. E. New York City.	With R. D. Mershon, 11 Pine street.
RIDDLE, HOWARD S., 1897, E. E. Columbus, Ohio.	Engineer, Jeffrey Mfg. Co.
RIGDON, CARL, 1905, M. E. Pittsburg, Pa.	Erecting Engineer, Westinghouse Machine Co.
RIGHTMIRE, R. E., 1902, M. E. Columbus, Ohio.	Special Apprentice, Hocking Valley Railway Co.
RITCHIE, GEORGE A., 1903, C. E. Columbus, Ohio.	Contracting Engineer.
ROBINSON, ERDIS G., 1893, C. E. Columbus, Ohio.	Secretary and Treasurer, Robinson-Tilton Machinery Co.
ROBINSON, RICHARD W., 1905, C. E. Amridge, Pa.	With American Bridge Co.
ROBINSON, LOUIS G., 1905, M. E. Louisville, Ky.	With Standard Sanitary Mfg. Co.
ROGERS, JAMES B., 1896, E. M. Ashland, Ky.	Supt. Blast Furnace.
ROOT, WILLIS J., 1885, E. M. Columbus, Ohio.	General Supt., Carnegie Steel Co., Columbus Works.
ROSE, CLAUDE C., 1905, M. E. Columbus, Ohio.	With Pneumatic Tool Company.
ROSS, CALVIN B., 1903, E. E. Springfield, Ohio.	Engineer and Draftsman, Hopper Mfg. Co.

Rowlee, Henry A., 1897, M. E... Philadelphia, Pa.	Inspector of Ordnance, U. S. A., Midvale Steel Works.
Royon, Eduoard D., 1904, M. E.. Lynn, Mass.	In Testing Dept., General Electric Co.
Ruhlen, Carl M., 1898, M. E... Port Townsend, Wash.	Superintendent of Construction, Quartermaster's Dept., U. S. Army.
Ryland, Paul D., 1901, C. E..... Bluefield, W. Va.	Roadmaster, Norfolk & Western Railway.

S

Sayers, Delbert B., 1905, E. M... Stonega, Va.	Chief Eng., Stonega Coal & Coke Co.
Sargent, Edward C., 1906, C. E. New Kensington, Pa.	The Pittsburg Reduction Co.
Schaaf, Downs, 1905, E. M..... Omaha, Neb.	Laboratory of N. P. R. R. Co.
Schaub, E. L. T., 1885, M. E..... Columbus, Ohio.	Draftsman, Jeffrey Mfg. Co.
Schaup, Charles E., 1897, E. M. Berrysburg, W. Va.	Chief Engineer, Southern Coal & Transportation Co.
Scheibell, Wm. O., 1888, E. M... Columbus, Ohio.	Consulting and Contracting Engineer for Concrete Construction.
Schertz, William A., 1904, E. E. Cincinnati, Ohio.	With Bullock Elec. Mfg. Co.
Schlafly, Roydon K., 1903, C. E. Columbus, Ohio.	Assistant Professor of Civil Engineering, O. S. U.
Schreiber, George E., 1900, E. E. St. Louis, Mo.	Engineer and Contractor.
Schreiber, John M., 1899, E. E.. Newark, N. J.	Engineer, M. of W., Publlic Service Corporation.
Schroll, Otto, 1886, C. E........ Toledo, Ohio.	Superintendent, Toledo Division Penn. Lines.
Schubert, C. W., 1903, C. E..... Mt. Vernon, Ohio.	Draftsman, Mt. Vernon Bridge Works.
Schultz, August C., 1905, C. E. Sandusky, Ohio.	City Engineer.
Schupp, Peter V., 1906, E. E.... 2268 Norwood Ave., East Norwood, Ohio.	Student Apprentice, Allis-Chalmers Co.
Schwab, Frank W., 1902, B. Sc. (Chem.) Newcomerstown, Ohio.	Chemist, James B. Clow & Sons.
Sedgwick, Edgar C., 1895, E. E... Columbus, Ohio.	Chief Engineer, The Case Mfg. Co.
Senter, Herbert P., 1902, C. E... Columbus, Ohio.	In City Engineer's Office.
Serva, Adam A., 1893, E. E...... Fort Wayne, Ind.	Assistant Sales Manager and Assistant Secretary, Fort Wayne Electric Works.
Shapter, G. H., 1905, E. E....... Schenectady, N. Y.	With General Electric Co.

Sharp, Charles C., 1888, C. E... Gauley Bridge, W. Va.	Coal Mine Operator.
Shaw, Lucian, 1904, C. E....... W. Lafayette, Ohio.	Contractor.
Shepard, Harvey L., 1903, B. Sc. (Chem.) Cincinnati, Ohio.	Chemist, Queen City Printing Ink Co.
Shepherd, C. W., 1900, C. E..... Chicago, Ill.	In Structural Dept., North Works, Illinois Steel Co.
Sherman, Chris. E., 1894, C. E.. Columbus, Ohio.	Professor of Civil Engineering, Ohio State University.
Sherman, John K., 1901, C. E... Richmond, Ind.	Asst. Eng., Penna. Lines, West of Pittsburg.
Shrock, John H., 1906, M. E.... Bucyrus, Ohio.	With New York Blower Co.
Sill, Edgar T., 1904, E. E........ Pittsburg, Pa.	In Testing Dept., Westinghouse Elec. & Mfg. Co.
Simonton, Mark, 1895, E. E..... Columbus, Ohio.	Manager, Electric Supply & Construction Co.
Singleton, Fred., 1904, M. E..... Columbus, Ohio.	With Hocking Valley R. R.
Skinner, C. E., 1890, M. E...... Pittsburg, Pa.	Engineer, Electrical Engineering Dept., Westinghouse Elec. & Mfg. Co.
Sloctemyer, Carl F., 1903, E. E. Cincinnati, Ohio.	In Eng. Dept., Cincinnati Traction Co.
Smith, Carl Joseph, 1905, E. M. Columbus, Ohio.	With Scioto Traction Co.
Smith, David W., 1899, C. E..... Columbus, Ohio.	Division Engineer, Hocking Valley R. R.
Smith, Harry Ford, 1902, M. E.. Lexington, Ohio.	Manager, Smith Gas Power Company.
Smith, Hubert P., 1906, M. E... Pittsburg, Pa.	
Smith, Roy B., 1904, M. E....... Columbus, Ohio.	Apprentice, Motive Power Dept., Penn. Lines.
Snider, C. M., 1897, B. Sc. (Ind. Arts.) Columbus, Ohio.	Mechanical Engineer, The Jeffrey Mfg. Co.
Snow, Franklin C., 1906, E. E.. Elyria, Ohio.	
Sosman, Robert B., 1903, B. Sc (Chem.), Boston, Mass.	Chemist, with A. D. Little, Chemical Expert and Engineer.
Sperr, Frederick W., 1883, E. M. Houghton, Mich.	Professor of Civil and Mining Engineering, Michigan College of Mines.
Spitler, Grovey O., 1904, B. Sc. (Chem.) St. Louis, Mo.	With U. S. Fuel Testing Plant.
Sprague. C. M., 1899, C. E....... Chicago, Ill.	Assistant on Engineers' Corps, P., C., C. & St. L. Ry.
Sproat, Amasa D., 1902, E. M... Fresnilla, Zac., Mexico.	Superintendent Fresnillo Mining Co.

SPURRIER, JOHN R., 1896, E. E...	
STALEY, MARCELLUS, 1899, E. E... New York City.	Firm of Staley & Gillespie, Electrical Contractors.
STANTON, FRED. M., 1904, B. Sc. (Chem.) St. Louis, Mo.	With U. S. Fuel Testing
STARBUCK, DANIEL K., 1899, E. E. Schenectady, N. Y.	With General Electric Co.
STELLHORN, ADOLF, 1900, A. B.; 1903, C. E. Columbus, Ohio.	Transitman, City Engineer's Office.
*STEWART, ALTON R., 1904, E. E.	Died November 1, 1906.
STEWART, HARFORD T., 1896, E. E. Columbus, Ohio.	Secretary, Case Mfg. Co.
STEWART, LEE R., 1896, C. E..... Camden, N. J.	Engineer in Charge of Mould Loft, New York Ship Building Co.
STEWART, WALTER S., 1905, E. M. 1417 S. 14th St., Denver, Col.	Engineer.
STINEBAUGH, ISAAC L., 1892, C. E. Tiffin, Ohio.	Asst. County Surveyor.
STOCKER, JAMES A., 1902, C. E... Charleston, W. Va.	Division Engineer, Kanawha & Michigan Railway.
STONE, CARLTON E., 1899, C. E... Pittsburg, Pa.	With the P. & L. E. Ry.
STONE, THOMAS W., 1902, M. E.. Fort Wayne, Ind.	Asst. Engineer, Western Gas Construction Co.
STORER, NORMAN W., 1891, E. E.. Pittsburg, Pa.	Elec. Engr., Railway Dept., Westinghouse Elec. & Mfg. Co.
STORER, SIMON B., 1893, E. E..... Buffalo, N. Y.	General Manager, Niagara, Lockport and Ontario Power Co.
STRAUB, ALBERT A., 1906, M. E... Columbus, Ohio.	Assistant in Mechanical Engineering, O. S. U.
STROM, LEWIS H., 1906, C. E..... Niagara Falls, N. Y.	With Buffalo, Thousand Islands and Portsmouth R. R.
STULL, EMMETT W., 1894, E. E... Cincinnati, Ohio.	Engineer, Railway Dept., Bullock Elec. Mfg. Co.
STULL, RAYMOND T., 1902, E. M. (Ceramics.) Mt. Savage, Mo.	With Andrew Ramsey, Mfg., Enameled Brick.

T

TAGGART, JOHN M., 1906, C. E.... Cambridge, Ohio.	With Penna. Lines.
TANNER, EDWARD W., 1902, M. E. Bedford, Ohio.	Draftsman, The Interstate Engineering Co.
TAYLOR, ARTHUR W., 1893, E. M. Cleveland, Ohio.	Chemist, Otis Steel Co., Ltd.
TAYLOR, WILLIAM O., 1904, E. E. Cincinnati, Ohio.	Com'l Dept., Allis-Chalmers Co.

Templin, John R., 1903, M. E. Christ Church, New Zealand.	With General Electric Co.
Tenney, Edward H., 1905, M. E. St. Louis, Mo.	Superintendent Pipe Installation, Union Electric Light & Power Co.
Thomas, Edward, 1904, B. Sc. (Chem.) Copley, Pa.	Cement Inspector.
Thomas, James O., 1897, C. E. Columbus, Ohio.	Citizens Telephone Co.
Todd, Percy F., 1906, M. E. Mt. Vernon, Ohio.	With C. & G. Cooper Co.
Towne, Robert S., 1879, B. Sc.; 1880, E. M. 82 Beaver St., New York City.	President, Campania Metallurgica Mexicana.
Tufts, Charles H., 1899, E. E. Pittsburg, Pa.	Chief Chemist, Shoenberger Wks, Am. Steel & Wire Co.
Turner, Arthur M., 1893, E. E. 726 Farrell Ave., Chicago, Ill.	With Barnhart Bros. & Spindler.

U

Urban, Harry M., 1898, C. E. Birmingham, Ala.	Department Engineer, U. S. Tube Works.

V

Van Dyke, C. S., 1902, E. E. Schenectady, N. Y.	In Testing Dept., General Electric Co.
Van Tine, C. H., 1903, M. E. Muncie, Ind.	Draftsman, Indiana Bridge Co.
Vandervoort, W. P., 1886, E. M. Morrow, Ohio.	Supt. of Schools.
Vennum, Geo. C., 1905, M. E. St. Louis, Mo.	With Union Electric Light & Power Co.
Viets, Willis B., 1886, E. M. Pittsburg, Pa.	Chemist, Neville Furnace, Am. Steel and Wire Co.
Vosskuehler, J. H., 1900, M. E. Madison, Wis.	Instructor in University of Wisconsin.

W

Wadsworth, F. L. O., 1888, E. M.; 1889, B. Sc., M. E. Pittsburg, Pa.	Chief Engineer, American Window Glass Co.
Walker, Downie R., 1905, M. E. Beloit, Wis.	With Fairbanks-Morse Co.
Walker, James M., 1896, C. E. Roanoke, Va.	Res. Eng., Tidewater R. R.
Walthour, Frederick D., 1906, M. E. 325 W. 58th St., N. Y. City.	With the New York Telephone Co.

Ward, Kenneth B., 1905, C. E... Columbus, Ohio.	Assistant in Civil Engineering, Ohio State University.
Ward, Samuel E., 1904, M. E... Pittsburg, Pa.	With Westinghouse Machine Co.
Ward, Vernon C., 1903, M. E... Chicago, Ill.	Estimator, North Works, Illinois Steel Co.
Watson, William G., 1906, E. M. Lark, Utah.	With Bingham Consolidated Mining and Smelting Co.
Watt, Sern P., 1886, M. E...... Seattle, Wash.	Mechanical Designer, Moran Bros. Co.
Watters, Burr S., 1904, M. E.... Columbus, Ohio.	Asst. Eng., M. of W., Columbus Railway & Light Co.
Way, Karl M., 1905, E. M...... St. Louis, Mo.	With U. S. Fuel Testing Plant.
Weaver, George H., 1905, M. E... Lorain, Ohio.	With Brown Cochran Gas Engine Co.
Webber, Frank M., 1903, E. E... Fort Wayne, Ind.	In Sales Dept., Fort Wayne Electric Works.
Weber, F. Clarence, 1901, B. Sc. (Chem.) Washington, D. C.	With Bureau of Chemistry, U. S. Agricultural Dept.
Weick, C. W., 1898, B. Sc. (Ind. Arts.) , New York City.	Instructor in Manual Training, Teachers' College, Columbia University.
Weinland, Herman G., 1905, M. E. Springfield, Ohio.	Asst. Supt. Lagonda Mfg. Co.
Welch, Clark J., 1888, C. E..... 11 Broadway, New York City.	Bridge and Structural Engineer.
Welch, Oliver B., 1895, E. E.... Dennison, Ohio.	General Manager, United Elec. Co.
Wellbaum, Arvy E., 1902, M. E. Mt. Gilead, Ohio.	Engineer, Hydraulic Press Co.,
Welty, Albert B., 1906, B. Sc. (Ind. Arts.) Racine, Wis.	With Case Threshing Machine Co.
Wilcox, Alva N., 1895, E. E.... Dayton, Ohio.	The Pinneo & Daniels Co.
Wilcox. Carl C., 1903, M. E..... Columbus, Ohio.	Fellow in Mechanical Eng., O. S. U.
Wilkinson, Clarence M., 1906, M. E. Chicago, Ill.	With Otis Elevator Co.
Williams, Ernest D., 1905, M. E. Schenectady, N. Y.	Steam Turbine Eng. Dept., General Electric Co.
Williams, Harry E., 1902, M. E. Omaha, Neb.	Special Apprentice, Union Pacific R. R. Shops.
Williams, Ralph D., 1906, E. E. Chicago, Ill.	Student Apprentice, Western Electric Co.
Williams, S. B., 1905, E. E..... Chicago, Ill.	Tel. Dept., Western Electric Co.
Williamson, Arba G., 1906, E. E. 560 Washington Ave., Carnegie, Pa.	Signal Dept., Penna. R. R.

Williamson, H. D., 1901, B. Sc. (Chem.); M. D. Starling Med. Col., 1904. Lorain, Ohio.	Physician
Wise, Albert Joseph, 1898, C. E. Houston, Tex.	Civil Engineer.
Wise, James G., 1906, C. E. 17 W. 124th St., N. Y. City.	Draftsman, N. Y. C. & H. R. R. R.
Wolf, Herman H., 1895, C. E. Washington, D. C.	Lieutenant, U. S. Revenue Cutter Service.
Wolfe, Arthur C., 1905, M. E. Mt. Vernon, Ohio.	With C. & G. Cooper Co.
Wyer, Samuel S., 1903, M. E. Highland St., Columbus, O.	Manufacturer Gas Specialties.
Wylie, Arthhr R., 1905, M. E. Spokane, Wash.	With Fairbanks-Morse Co.
Wynne, Francis E., 1902, E. E. Pittsburg, Pa.	With Westinghouse Electric & Manufacturing Co.

Y

Yost, Lloyd, 1902, M. E. Warren, Pa.	With Struthers, Wells & Co.
Youmans, Wm. R., 1903, E. E. Schenectady, N. Y.	In Testing Dept., General Electric Co.

Z

Zaumseil, Oscar C., 1887, C. E. Webb City, Mo.	Merchant.
Zeller, Howard R., 1906, E. M. Findlay, Ohio.	
Zurfluh, Wm. N., 1894, E. E. Springfield, Ohio.	Superintendent, Home Lighting, Power & Heating Co.

The Ohio State University Bulletin is published fifteen times during the academic year, as follows: Monthly in October, November, and June, and bi-weekly in December, January, February, March, April, and May.

0h230

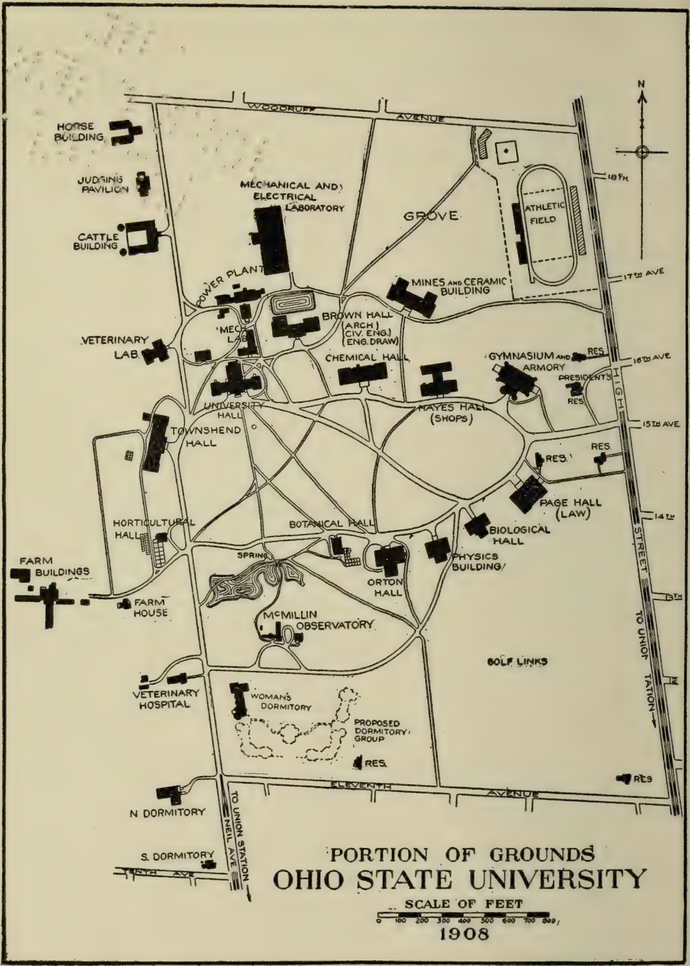
VOLUME XII NUMBER 11

Ohio State University Bulletin

College of Engineering

April 9, 1908

PUBLISHED BY THE UNIVERSITY AT COLUMBUS
Entered as second-class matter November 17, 1905, at the postoffice at Columbus, Ohio, under Act of Congress, July 16, 1894.



PORTION OF GROUNDS
OHIO STATE UNIVERSITY

1908

OHIO STATE UNIVERSITY

The Ohio State University, located in Columbus two miles north of the Union Station, is a part of the public educational facilities maintained by the State. It comprises seven colleges:

The College of Agriculture and Domestic Science,
The College of Arts, Philosophy, and Science,
The College of Education,
The College of Engineering,
The College of Law,
The College of Pharmacy,
The College of Veterinary Medicine,

This bulletin of announcements is devoted exclusively to the work of the College of Engineering.

(NOTE: In requesting any of the announcement bulletins of the University, address the University Editor, Ohio State University, Columbus, Ohio.)

UNIVERSITY CALENDAR

1908

Entrance examinations, (8 a. m.) Tuesday to Saturday, June 16 to 20.

Summer courses in Surveying, June 19 to July 18.

Summer courses in Shop-Work, June 22 to July 18.

Summer term, June 22 to August 14.

Entrance examinations, (8 a. m.) Tuesday to Saturday, September 15 to 19.

First term begins—Registration Day—Tuesday, September 22.

President's Annual Address, (11 a. m.) Friday, September 25.

Latest date of omission to candidacy for a degree at the Commencement of June, 1909, Thursday, October 1.

Tranksgiving recess, November 27 and 28.

Latest date for filing thesis subject, Tuesday, December 15.

First term ends, Wednesday, December 23.

CHRISTMAS VACATION

1909

Second term begins—Registration Day—Tuesday, January 5.

Washington's Birthday, Monday, February 22.

Second term ends, Friday, April 2.

SPRING RECESS

Third term begins—Registration Day—Wednesday, April 7.

Field Day—Athletic Association—Saturday, May 8.

Competitive Drill—Cadet Regiment—Saturday, May 22.

Final examinations, Friday to Thursday, June 11 to 17.

Latest date for presenting thesis, Saturday, June 12.

Entrance examinations, (8 a. m.) Tuesday to Saturday, June 15 to 19.

Latest date for filing bound copy of thesis, Friday, June 18.

Commencement, Wednesday, June 23.

COLLEGE OF ENGINEERING

PURPOSE AND AIMS

The purpose of the College of Engineering is to thoroughly ground students in the fundamental sciences and arts upon which all engineering rests; to impart such special and technical knowledge of the various branches of engineering as is practicable in the time available; and finally, by the severe scholastic discipline of this training, together with collateral work in language and literature, to impart an appreciation of the pleasures of culture and scholarship, and a recognition of the civic duties and moral responsibilities which in modern society fall upon every educated man.

In the attainment of these inseparable ends, the work of the College of Engineering is directed, first, to the mastery of the principles of mathematics, physics, and chemistry by means of theoretical courses; second, by laboratory work in these and related sciences and in the graphic arts, to fix principles firmly in the mind of the student and develop his power to apply them to concrete cases; third, to give such opportunity for specialization in the various fields and departments of engineering as its constantly increasing scope and subdivision renders possible. Added to these technical subjects, instruction is given in the use of English, developing the power to write clear and concise reports, and in at least one foreign language sufficient to bring the technical literature of that language within grasp.

It is recognized that the graduate of any engineering school can have at best but a meagre equipment in the actual knowledge of engineering, and that he must inevitably be largely lacking in the experience and mature judgment which the competent engineer brings to his work. But he can at least gain at school a good foundation for accurate reasoning and sound judgment, and it is believed that these qualities are developed in higher degree by such carefully prescribed courses as are here offered, than in partially or wholly elective courses.

The great expansion in technical education witnessed in the last two decades has been due to two causes, first, the rapid growth of the manufacturing industries and of the great public works by which their products are distributed, and second, by the constantly increasing conviction in the minds of manufacturers and administrators that the capable, self-reliant and truthworthy men whom they need are produced in fuller degree by the rigid training of an engineering school than by any other means.

COURSES OFFERED

This college offers instruction in nine important fields of engineering work. Covering these the following four-year courses of study are offered:

1. Architecture, leading to the degree of Civil Engineer in Architecture (C. E. in Arch.).

2. Ceramics, leading to the degree of Ceramic Engineer (Cer. E.).

3. Chemical Engineering, leading to the degree of Bachelor of Science in Chemical Engineering (B. Sc.).

4. Civil Engineering, leading to the degree of Civil Engineer (C. E.).

5. Electrical Engineering, leading to the degree of Mechanical Engineer in Electrical Engineering (M. E. in E. E.).

6. Industrial Arts, leading to the degree of Bachelor of Science in Industrial Arts (B. Sc.).

7. Manual Training, leading to the degree of Bachelor of Science in Industrial Arts (B. Sc.)

8. Mechanical Engineering, leading to the degree of Mechanical Engineer (M. E.).

9. Mine Engineering, leading to the degree of Engineer of Mines (E. M.).

The following two-year, or short courses, do not lead to a degree, but students completing them are furnished a formal certificate stating the work they have accomplished:

10. Clay-working.

11. Industrial Arts and Shopwork.

12. Mining.

The necessary instruction for these courses of study is given in twenty-three different departments under eighty-eight professors and assistants. In some of these courses there is opportunity for elective work, which may be selected from any of the forty departments of the University. The library of about 75,000 volumes includes the most important treatises in the different fields of engineering.

FACULTY AND INSTRUCTORS

WILLIAM OXLEY THOMPSON, D. D., LL. D., PRESIDENT OF THE UNIVERSITY.

SIDNEY AUGUSTUS NORTON, Ph. D., LL. D., Emeritus Professor and Lecturer in Chemistry.

STILLMAN W. ROBINSON, C. E., D. Sc., Emeritus Professor of Mechanical Engineering.

RFBERT WHITE MCFARLAND, LL. D., Emeritus Professor of Civil Engineering.

FRANK ARNOLD RAY, E. M., DEAN and Professor of Mine Engineering.

JAMES ELLSWORTH BOYD, M. S., SECRETARY and Professor of Mechanics.

NATHANIEL WRIGHT LORD, E. M., Professor of Metallurgy and Mineralogy and Director of the School of Mines.

EDWARD ORTON, JR., E. M., Professor and Director of the Department of Clay-working and Ceremics.

BENJAMIN FRANKLIN THOMAS, Ph. D., Professor of Physics.

ROSSER DANIEL BOHANNAN, B. Sc., C. E., E. M., Professor of Mathematics.

BENJAMIN LESTER BOWEN, Ph. D., Professor of Romance Languages and Literatures.

*JOSEPH VILLIERS DENNEY, B. A., Professor of English.

WILLIAM THOMAS MAGRUDER, M. E., Professor of Mechanical Engineering.

WILLIAM MCPHERSON, JR., D. Sc., Ph. D., Professor of Chemistry.

JOSEPH NELSON BRADFORD, M. E., Professor of Architecture and Drawing.

FRANK EDWIN SANBORN, S. B., Professor and Director of the Department of Industrial Arts.

HENRY CURWEN LORD, B. Sc., F. R. A. S., Professor of Astronomy and Director of the Emerson McMillin Observatory.

EMBURY ASBURY HITCHCOCK, M. E., Professor of Experimental Engineering.

FRANCIS CARY CALDWELL, B. A., M. E., Professor of Electrical Engineering.

*CHARLES SMITH PROSSER, Ph. D., Professor of Geology.

CHRISTOPHER ELIAS SHERMAN, C. E., Professor of Civil Engineering.

LEWIS ADDISON RHOADES, Ph. D., Professor of Germanic Languages and Literatures.

FRANK HARVEY ENO, B. Sc., C. E., Professor of Municipal Engineering.

---

*Absent on leave, 1907-1908.

THOMAS EWING FRENCH, M. E., Professor of Engineering Drawing.

GEORGE WASHINGTON MCCOARD, M. A., Associate Professor of Mathematics.

WILLIAM EDWARDS HENDERSON, Ph. D., Associate Professor of Chemistry.

CHARLES A. BRUCE, B. A., Associate Professor of the Romance Languages and Literatures.

CHARLES WILLIAM FOULK, B. A., Associate Professor of Chemistry.

G. A. ANDREGG, A. M., Associate Professor of Electrical Engineering.

MATTHEW BROWN HAMMOND, Ph. D., Associate Professor of Economics and Sociology.

CLYDE T. MORRIS, C. E., Associate Professor of Civil Engineering.

KARL DALE SWARTZEL, B. Sc., Associate Professor of Mathematics.

EDWARD ELSWORTH SOMERMEIER, G. Ph., Associate Professor of Metallurgy and Mineralogy.

HARRY WALDO KUHN, Ph. D., Associate Professor of Mathematics.

FREDERICK EDWARD KESTER, Ph. D., Associate Professor of Physics.

WILLIAM ABNER KNIGHT, M. E., Assistant Professor of Machine-Shop Practise.

HORACE JUDD, M. E., M. Sc., Assistant Professor of Experimental Engineering.

EDWIN F. CODDINGTON, Ph. D., Assistant Professor of Mechanics.

ROBERT F. EARHART, Ph. D., Assistant Professor of Physics.

WILLIAM LLOYD EVANS, Ph. D., Assistant Professor of Chemistry.

CARSON SAMUEL DUNCAN, M. S., Assistant Professor of English.

GEORGE D. HUBBARD, Ph. D., Assistant Professor of Geology.

ROY K. SCHLAFLY, C. E., Assistant Professor of Civil Engineering.

BERTHOLD AUGUST EISENLOHR, M. A., Assistant Professor of the Germanic Languages and Literatures.

SAMUEL EUGENE RASOR, B. Sc., Assistant Professor of Mathematics.

THOMAS KENYON LEWIS, B. Sc., Assistant Professor of Engineering Drawing.

JAMES RENWICK WITHROW, Ph. D., Assistant Professor of Chemistry.

JOHN HERMAN HUNT, B. S. in E. E., Assistant Professor in Electrical Engineering.

ROSS C. PURDY, Assistant Professor of Clay-working and Ceramics.

CHARLES ST. JOHN CHUBB, Jr. C. E. (Arch.), Assistant Professor of Architecture.

OLIVE JONES, B. A., Librarian.

GEORGE L. CONVERSE, Captain U. S. A. (Retired), Professor of Military Science and Tactics.

H. SHINDLE WINGERT, M. D., Director of Physical Education for Men.

JOHN ADAMS BOWNOCKER, D. Sc., Professor of Inorganic Geology and Curator of the Museum.

DAVID R. MAJOR, Professor of Psychology.

JAMES EDWARD HAGERTY, Ph. D., Professor of Economics and Sociology.

WILLIAM LUCIUS GRAVES, M. A., Assistant Professor of English.

CHARLES LINCOLN ARNOLD, M. Sc., Assistant Professor of Mathematics.

Edgar S. Ingraham, Ph. D., Assistant Professor of Romance Languages.

Fayette A. McKenzie, Ph. D., Assistant Professor of Economics and Sociology.

Carl Rigdon M. E., Assistant Professor of Mechanical Engineering.

Charles Philip Crowe, Instructor in Forging.

John Satterlee Tidball, B. S., Instructor in Engineering Drawing.

Ralph Rogers, Instructor in Engineering Drawing.

May Thomas, Ph. D., Instructor in German.

Robert Meiklejohn, M. E., Instructor in Engineering Drawing.

F. C. McKinney, M. A.., Instructor in English.

Frank Kelton Bailey, Ph. D., Instructor in Physics.

W. J. Norris, Instructor in Engineering Drawing.

Clarence Charles Vogt, A. B., Instructor in Chemistry.

J. Warren Smith, M. Sc., Lecturer on Meteorology.

Allando Case, Instructor in Vise Work.

C. W. Beem, Instructor in Patternmaking and Founding.

F. H. Heskett, Instructor in Architecture.

Edmund S. Manson, Jr., S. M., Instructor in Astronomy.

Charles S. Sheard, M. A., Instructor in Physics.

William F. Gephart, M. A., Instructor in Economics and Sociology.

John B. Parker, M. A., Instructor in English.

George Robert Bott, M. E., Instructor in Civil Engineering.

Clarence A. Dykstra, B. A., Instructor in American History and Political Science.

John Ross Chamberlain, Assistant in Civil Engineering.

Kenneth Baker Ward, C. E., Assistant in Civil Engineering.

JOHN McBRIDE KNOTE, M. A., Laboratory Assistant in Ceramics.

SAMUEL MORRIS, Assistant in Chemistry.

ULYSSES W. DENMAN, Assistant in Patternmaking.

CALVIN L. COGGINS, Assistant in Physics.

H. G. CARPENTER, Student Assistant in Mine Engineering.

ALFRED HENRY BARNES, Assistant in Physics.

J. THOMAS KIBLER, Assistant in Physical Education for Men.

W. F. MARTIN, Student Assistant in Experimental Engineering.

A. W. SCHORGER, B. A., Assistant in Chemistry.

CLIFFORD SHOEMAKER, Assistant in Civil Engineering.

ORSON E. WARFIELD, Assistant in Physical Education for Men.

WELSEY G. WORCESTER, Laboratory Assistant in Ceramics.

CHARLES E. FISHER, Assistant in Mechanical Engineering.

C. E. McQUIGG, Student Assistant in Metallurgy and Mineralogy.

G. J. ALSTETTER, Student Assistant in Metallurgy and Mineralogy.

D. R. KELLOGG, Assistant in Physics.

J. B. SHAW, Student Assistant in Civil Engineering.

HOWARD J. LUCAS, B. A., Assistant in Chemistry.

FELLOWS

CECIL E. BOORD, B. A., Chemistry.

LOU HELEN MORGAN, B. Ph., Chemistry.

J. WALTER SALE, B. A., Chemistry.

GEORGE W. STRATTON, B. A., Chemistry.

EDGAR J. WITZEMANN, B. A., Chemistry.

SHERMAN D. CHAMBERS, B. S., Mathematics.

GRACE BAREIS, B. A., Mathematics.

ADMISSION

Applicants for admission must be at least seventeen years of age.

UNIVERSITY ENTRANCE BOARD

The admission of students is in charge of the University Entrance Board, which determines the credits which shall be issued on all entrance examinations and certificates, and furnishes all desired information to applicants. Correspondence relating to admission should be addressed to the Entrance Board, Ohio State University, Columbus.

ADMISSION TO COURSES LEADING TO A DEGREE

There are two modes of admission to the courses leading to a degree: (a) by examination, (b) by certificate.

ADMISSION BY EXAMINATION

The Entrance Board will conduct entrance examinations June 16 to 20 and September 15 to 19, 1908. A part of the examinations may be taken in June and the remainder in September. All applicants for admission who are not graduates of an accredited or recognized secondary school or approved preparatory school, or who do not possess certificates from the State Board of School Examiners, must take examinations for admission.

Schedule.—Examinations will be from 8 to 12 a. m. and from 1 to 5 p. m.

Tuesday

A. M.—Greek and Roman History, English History, General History.

P. M.—Composition and Rhetoric, Classics, Chemistry, Geology.

Wednesday

A. M.—Algebra, German, English Grammar, Descriptive Geography.

P. M.—Plane Geometry, Physical Geography, Arithmetic.

THURSDAY

A. M.—Civics, Solid Geometry, Zoology.
P. M.—Beginning Latin, Cæsar, Astronomy.

FRIDAY

A. M.—Physics, Physiology, Botany.
P. M.—U. S. History, French, English Literature.

SATURDAY

A. M.—Virgil, Cicero.

ADMISSION BY CERTIFICATE

Applicants may be admitted without examination on presentation of properly indorsed certificates from such secondary schools as have been accredited* or recognized by the University, or from approved normal schools, or from the State Board of School Examiners under the following provisions:

(a) If from secondary schools, the certificate must show that the applicant is a graduate in good standing of the school issuing it; and also must state in detail the studies pursued, the text-books used, the amount of work done in each study, the amount of time devoted to it, and the fact that the applicant has passed in the work.

(b) Any entrance requirement not covered by a certificate must be met by examination.

Blank certificates may be obtained by addressing the Secretary of the Entrance Board. Certificates should be filed out and returned to the University as early as possible after the close of schools in June. Since errors are frequently made in transcribing the school record on the blank form, the applicant should verify his certificate before presenting it to the Entrance Board and see that it gives him credit for all his school work.

---

*Regarding accredited and recognized schools, see page 100 and following.

REQUIREMENTS BY UNITS

Applicants to be admitted to full standing must obtain credit by examination or certificate for fifteen units, chosen from the five groups which follow, subject to the restrictions stated therein. (A unit is a course of study covering a school year of not less than thirty-five weeks, with four or five periods of at least forty-five minutes each per week.) No one under twenty-one years of age* will be admitted on less than thirteen units.

(A) ENGLISH GROUP

Two units are required in this group. An applicant presenting one unit in this group will be admitted *conditionally,* if his arrearage in all of the groups does not exceed two units. All arrearages must be made good within two years after admission. Preparation in excess of two units in this group may be offered in lieu of the extra units of group (E).

English Composition and Rhetoric	1 unit
English Classics	1 unit
English Literature	1 unit

(B) HISTORY GROUP

Two units are required in this group. An applicant presenting one unit in this group will be admitted *conditionally,* if his arrearage in all of the groups does not exceed two units. All arrearages must be made good within two years after admission. Preparation in excess of two units in this group may be offered in lieu of the extra units of group (E).

Civil Government	½ unit
United States History	½ or 1 unit
Mediaeval and Modern or General General History	½ or 1 unit
Greek and Roman History	½ or 1 unit
English History	½ or 1 unit

---

*A person twenty-one years of age, or over, who desires to pursue a special line of work and does not intend to become a candidate for a degree, may be admitted by vote of the Executive Committee to such classes as he is qualified to enter; provided, that if he afterwards becomes a candidate for a degree he must pass the requirements for admission at least one year before the degree is conferred. See "Admission to Special Studies."

(C) MATHEMATICS GROUP

Three units are required in this group. An applicant presenting two and one-half units in this group will be admitted *conditionally,* if his arrearage in all of the groups does not exceed two units. All arrearage must be made good within two years after admission.

Algebra (through quadratics)	1 unit
Algebra (beyond quadratics)	½ nit
Geometry (plane)	1 unit
Geometry (solid and spherical)	½ unit

(D) SCIENCE GROUP

Two units are required in this group, including physics. An applicant presenting one unit in this group will be admitted *conditionally,* if his arrearage in all of the groups does not exceed two units. All arrearages must be made good within two years after admission. Preparation in excess of two units in this group may be offered in lieu of the extra units of group (E).

Physics	1 unit
Physical Geography	½ or 1 unit
Botany	½ or 1 unit
Chemistry	1 unit
Physiology	½ unit
Zoology	½ or 1 unit
Geology	½ unit
Astronomy	½ unit

(E) FOREIGN LANGUAGE GROUP

Six units are required in this group; or two extra units from the preceding groups, and four* units from this. A deficiency of two units is allowed in this group if the total arrearage in all of the groups does not exceed two units. All arrearages must be made good within two years after admission.

Applicants who have had not less than two years of technical experience acceptable to the executive committee may have such experience substituted for not more than two units of the entrance requirements in foreign languages.

Latin	2, 3, or 4 units
Greek	2, 3, or 4 units
German	2, 3, or 4 units
French	2, 3, or 4 units
Spanish	2, 3, or 4 units

---

*For the year 1908-9 an extra unit from any other group will be substituted for one of the four required units in this group.

A single unit in a foreign language will not be counted toward entrance.

An applicant twenty-one years of age or over, who is deficient in foreign language training will be admitted with a total deficiency of four units, provided at least two of the four are in the foreign language group.

The extent and character of the work required in each subject mentioned above is indicated on page 94 and following.

ADMISSION WITH ADVANCED STANDING

Applicants who have completed at least one year's work in an approved college, and who bring official and explicit certificates describing their courses of study and scholarship, and letters of honorable dismissal, will be admitted in accordance with either of two plans:

(1) The entrance units on which the candidate was admitted to the approved college will be accepted at their face value; deficiencies will be made up from the college credits presented, and advanced credit will be given for any remaining satisfactory work; or

(2) One year's work will be accepted in lieu of entrance units and the candidate will be admitted without examination and without conditions, but without any advanced standing on the year's work.

Applicants who have completed less than one year's work in an approved college must satisfy the entrance requirements in the usual way, and will then be given credit for any satisfactory work for which they can offer certificates.

ADMISSION TO SPECIAL STUDIES

Students who desire to pursue special lines of work in the University, and do not intend to become candidates for degrees, will be admitted on the following conditions:

1. The regular entrance requirements must be satisfied.

But applicants who are not less than twenty-one years of age, after obtaining credit for elementary or "grade" work, and for such other subjects as may be necessary to qualify them for the classes that they wish to enter, may, on the presentation of satisfactory reasons, be admitted by the joint action of the Entrance Board and the Executive Committee of the College, to any class in the College; provided, that if any student who has been admitted on these conditions afterwards becomes a candidate for a degree, he shall take the omitted entrance examinations at least one academic year before the degree is conferred.

2. Before entering the College, students desiring to pursue special work are required to lay before the Executive Committee, for approval or modification, a written statement of the end they have in view, the studies proposed for the attainment of that end, and the probable period of attendance. Such students will be held as strictly to their accepted schemes of work as are the regular undergraduates to their courses of study.

3. Permission to enter as special undergraduates will be refused to all who fail to give satisfactory evidence of definiteness of purpose and will be withdrawn whenever the conditions on which it was granted cease to exist.

ADMISSION TO THE SHORT COURSES

Applicants must be at least seventeen years of age, and, unless they are over twenty-one years of age, must pass examinations in Arithmetic and Geography, and must be able to write a business letter or a short theme, correct in grammar and orthography; or they must present satisfactory certificates showing that they have successfully pursued these subjects elsewhere. In addition, each applicant under twenty-one years of age must present a letter or certificate showing that he has had at least one year's practical experience in some industry related to the course which he wishes to pursue.

Applicants over twenty-one years of age are admitted without examination, and without letter or certificate of practical experience.

REMOVAL OF ENTRANCE CONDITIONS

The removal of entrance conditions is administered by the Entrance Board. Conditions may be removed (1) by examination (for schedule of examinations see page 13);

or (2) by the substitution of excess work in other approved subjects; or (3) by the substitution of other equivalent work to be done at the University at such times and in such subjects as the Entrance Board shall direct. All entrance conditions must be removed before the beginning of the third year of residence at the University, and a condition in Physics before the beginning of the second year.

COURSES OF STUDY

All engineering education is based on the constant use of the fundamental sciences, mathematics, physics, and chemistry, supplemented by training in the art of expression by both language and drawing. It naturally follows that all engineering courses start from a common point, proceed side by side for a time, but specialize and subdivide more and more as they progress toward completion, until in the last year they present but little work in common.

Further, it is very commonly the case with young men entering college for a technical education, that they are following ambitions not founded on any knowledge of their own natural aptitudes or capacities, and that they are in no way prepared to make a wise or final selection of their life work at that time.

For these two reasons the work of the first year is made identical in all of the engineering courses leading to a degree. The student is enrolled as a "First-year Engineer.' His selection of the course he wishes to pursue is deferred to the latter part of his first year, by which time he has become acquainted to some extent with University standards and methods, with the scope of the various courses offered, and with his own tastes and powers.

OUTLINE OF THE FIRST YEAR'S WORK OF ALL FOUR-YEAR COURSES

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

FIRST TERM		SECOND TERM		THIRD TERM	
Mathematics (31) Algebra.	5.	Mathematics (32) Trigonometry.	5.	Mathematics (33) Analytics.	5.
Chemistry (7 or 44) Inorganic.	4.	Chemistry (7 or 44) Inorganic.	4.	Chemistry (12) Qualitative Analysis.	4.
Modern Language French, Ger. or Span.	4.	Modern Language French, Ger. or Span.	4.	Modern Language French, Ger. or Span.	4.
English (1) Composition.	2.	English (1) Composition.	2.	English (1) Composition.	2.
Drawing (27) Freehand.	2.	Drawing (25) Freehand.	1.	Drawing (26) Freehand.	1
		Drawing (31) Geometric.	1.	Drawing (32) Lettering.	2.
Military Drill	1.	Military Drill	1.	Military Drill.	1.
Gymnasium	1.	Gymnasium	1.	Gymnasium.	1.

Students presenting Chemistry as an entrance subject will take Chemistry 44.

SUMMER TERM IN SHOPWORK—Students electing courses named below are required to take Shopwork courses in the summer term as follows:

Chemical Engineering—Shopwork (7) and (11) at the close of the first or second year.

Ceramics, Electrical Engineering, and Mechanical Engineering—Two from Shopwork (4), (7), and (11), at the close of the first year.

Industrial Arts—Shopwork (7) and (11), at the close of the first year.

COURSE IN ARCHITECTURE

This course is designed to combine with Architecture as a fine art a thorough training of those phases of engineering which deal with the problems of construction that must be solved before a building can be erected.

Drawing is an important factor in the education of the architect, including that of the artist and of the engineer and is presented in special courses dealing with the kinds of work which are most essential.

The history of architecture is taught by lectures, reference reading, and recitations, being freely illustrated by a selected set of lantern slides which familiarizes the student with the architecture of the past. Parallel with the history of architecture is a course of drawing which is devoted to the details of the "Orders" of architecture, Romanesque and Renaissance, thereby fixing firmly in mind the characteristics of each.

Decoration and ornament are taught by lectures and practise, consideration being given to the different styles of architecture in both form and color. Closely allied to this is a study of the principles of architectural composition, given by lectures and assigned problems.

Architectural design consists of preparing the necessary drawing, specifications, and estimates, for proposed structures, such as may be encountered in the practise of first-class professional architects.

The engineering and technical training comprises the following: Mathematics, mechanics, strength of materials, stresses in trusses and framed structures, steel skeleton construction and fireproofing for tall buildings, heating and ventilating, sanitary plumbing, masonry, concrete construction, and testing of materials.

FOR OUTLINE OF FIRST YEAR SEE PAGE 21

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

SECOND YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
Architecture (9) Hist. of Architecture.	3.	Architecture (10) Hist. of Architecture.	3.	Architecture (11) Hist. of Architecture.	3.
Architecture (12) The Orders.	2.	Architecture (13) Order Problems.	3.	Architecture (14) Order Problems.	3.
Drawing (33) Projections.	3.	Drawing (36) Descriptive Geom.	5.	Architecture (26) Arch. Perspective.	5.
Drawing (42) Charcoal Drawing from Arch. Ornament.	2.	Drawing (14) Pen Drawing.	2.	Drawing (14) Pen Drawing.	2.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.				
Military Drill	1.	Military Drill	1.	Military Drill	1.

SUMMER WORK

THIRD YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
Architecture (5) Decoration, etc.		Architecture (23) Designing.	4.	Architecture (17) Designing.	4.
Architecture (15) Designing.	4.	Architecture (27) Arch. Stereotomy.	4.	Architecture (24) Structural Details.	3.
Architecture (22) Arch. Composition.	2.	Drawing (18) Water Color.	2.	Drawing (19) Water Color.	2.
Architecture (33) Photography.		Drawing (40) Clay Modeling.	2.	Drawing (41) Clay Modeling.	2.
English (3) Brief-Making.	2.	English (3) Brief-Making.	2.	English (3) Brief-Making.	2.
Mechanics (1) Statics.	5.	Mechanics (2) Str'n'th Mat'ls.	5.	Civil Eng. (19) Trusses.	5.

SUMMER WORK

FOURTH YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
Architecture (18) Designing.	4.	Architecture (4) Specifications.	2.	Architecture (28) Estimating.	2.
Architecture (25) Plumbing.	2.	Architecture (21) Designing.	4.	Architecture (29) Professional Pract.	2.
Architecture (30) Monumental Design.	3.			Architecture (20) Thesis.	5.
Drawing (43) Charcoal Drawing from Antique.	2.			Architecture (19)	4.
Civil Eng. (34) Masonry.	3.	Civil Eng. (28) Steel Construction.	5.	Civil Eng. (21) Surveying.	3.
Mech. Eng. (23) Materials of Const'n.	4.	Civil Eng. (29) Cement Work.	3.		
		Mech. Eng. (42) Heating and Vent'ng.	3.		

THESIS

COURSE IN CERAMIC ENGINEERING

The ceramic industries include, according to the classification here adopted, those in which the production and utilization of natural and artificial silicates is the end in view; viz, clayware, glass, and cement. These three industries constitute a natural division of chemical technology.

Ceramic Engineering is the application of chemical technology and general engineering to this special group of non-metallic mineral industries. The ceramic engineer is supposed to be enough of a geologist to inspect a tract of country and determine whether it possesses mineral resources suited to silicate manufacture, and enough of a mine engineer to be able to economically win the deposits found, whether they are to be quarried superficially or mined deep in the earth. He must be enough of a mechanical engineer to transport, prepare, and manufacture these substances into their appropriate forms, rapidly and cheaply. Above all, he must be enough of a chemist to understand the nature of the processes taking place in kilns and furnaces, both as regards the generation of heat, and the formation of new silicate minerals from the earthy raw materials. The intimate relation existing between the composition and properties of silicate products throughout all ceramic operations, and the use of chemical control for maintaining these relations constant, make the training of the chemical laboratory absolutely necessary to the safe and progressive management of any modern ceramic industry.

These demands are broad and varied, but not more so than those of chemical engineering in general. The field of ceramic engineering is comparatively new in this country, the first course being offered in 1896. Ceramic engineers are compelled to a certain extent to act as pioneers in the field, but their employment on a constantly increasing scale is regarded as certain.

FOR OUTLINE OF FIRST YEAR SEE PAGE 21

SUMMER TERM.—Students are required to take *two* of the following courses in shopwork in the summer term at the close of the first year: Shopwork (4), (7), and (11).

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

SECOND YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (39) Drafting, etc.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Physics (3) Problems.	2.	Physics (3) Problems.	2.	Physics (3) Problems.	2.
Ceramics (1) Laboratory.	5.	Ceramics (2) Laboratory.	5.	Ceramics (3) Laboratory.	3.
				Ceramics (24) Ceramic Calculation.	2.
Military Drill	1.	Military Drill.	1.	Military Drill	1.

THIRD YEAR

Mechanics (1) Statics.	5.	Mechanics (2) Str'n'th Mat'ls, Kinet.	5.	Mech. Eng. (43) Mechanism.	5.
Ceramics (4) Raw Materials.	5.	Ceramics (5) Clay Products.	5.	Ceramics (6) Clay Products .	5.
Mine Eng. (4) Mine Surveying.	5.	Chemistry (30) Phys. Chem. Lectures.	3.	Ceramics (26) Phys. Chem. Meas.	5.
English (3) Brief-Making.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.
		Ceramics (25) Identification of Clays.	2.		

FOURTH YEAR

Ceramics (9) Manf. of Bodies.	5.	Ceramics (10) Glasses and Glazes.	5.	*Ceramics (11) Enamels, Colors.	5.
Metallurgy (4) Fuels and Iron.	5.	Civil Eng. (19) Trusses.	5.	*Ceramics (12) Cement.	5.
Geology (2) General.	5.	Geology (6) Economic.	3.	Ceramics (15) Thesis Work.	5.
		Geology (7) Petrography.	2.	Mech. Eng. (36) Laboratory.	5.
Architecture (33) Photography.		Drawing (22) Technical Draw.	2.	Drawing (23) Technical Draw.	2.

THESIS

---

*Students are to elect Ceramics (11) or (12).

COURSE IN CHEMICAL ENGINEERING

This course has been prepared to meet the growing demands for trained men in the numerous industries which are based upon chemical processes or employ them prominently in their work, and which are not included in the fields of metallurgy and ceramics. Among such may be mentioned the manufacture of acids, alkalies, salts, chemical reagents, paints, colors, dyes, bleaching powders, soaps, glue, gelatin, glycerine, tanning compounds, starch, sugar, dextrine, glucose, alcohol, ferments, preservatives, antiseptics, fertilizers, matches, and many others.

Much of this work has been done in the past without the aid of the chemist. At present it is recognized, however, that in order to carry on the work economically and compete with other countries, the service of the chemist is indispensable. Not only is he able to improve the methods and obtain better products, but he is often able to devise methods for utilizing the by-products and thus lower the cost of production.

The course differs from the ordinary course in chemistry in that it is extended greatly along the engineering lines. This is in accord with the views of the manufacturers as well as experts in technical chemistry. The manufacturer must not only understand the chemical reactions involved in processes; he must be able to devise machinery for carrying out these reactions on a large scale. Nearly all chemical industries are conducted by the aid of elaborate plants for mechanically treating the materials and handling the products, which in many cases cannot be dealt with by hand labor. Consequently mechanical engineering, and to a limited extent, electrical engineering, is demanded and used in these industries. The men at present entering these lines of work are largely mechanical engineers, well trained in this side of the work, but weak and inefficient on the chemical side, which is really fundamental.

FOR OUTLINE OF FIRST YEAR SEE PAGE 21

Summer Term.—Shopwork Courses (7) 3 and (11) 3 are to be taken in the summer term at the close of the first or second year.

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

SECOND YEAR

First Term		Second Term		Third Term	
Chemistry (20)	4.	Chemistry (20)	4.	Chemistry (20)	4.
Chemistry (21)	2.	Chemistry (21)	2.	Chemistry (21)	2.
Physics (2)	3.	Physics (2)	3.	Physics (2)	3.
Mathematics (41)	5.	Mathematics (42)	5.	Mathematics (43)	5.
Drawing (33)	3.	Drawing (34)	3.	Metallurgy (2)	3.
Chemistry (40)	1.	Chemistry (40)	1.		
Military Drill	1.	Military Drill	1.	Military Drill	1.

THIRD YEAR

English (3)	2.	English (3)	2.	English (3)	2.
Mechanics (1)	5.	Mechanics (2)	5.	Mechanics (3)	5.
Drawing (21)	2.	Drawing (22)	2.	Drawing (23)	2.
Chemistry (46)	2.			Mech. Eng. (32)	5.
Chemistry (47)	2.				
Metallurgy (4)	5.				
*Optional Work. GROUP I.		Chemistry (46)	2.	Chemistry (46)	2.
		Chemistry (47)	2.	Chemistry (47)	2.
		Chemistry (15)	4.		
*Optional Work. GROUP II.		Metallurgy (4)	5.		
		Metallurgy (6)	5.	Metallurgy (5)	5.

*Students wishing to specialize in metallurgical chemistry will elect Group II as their option; all others will elect Group I.

FOURTH YEAR

Chemistry (32)	4.	Chemistry (32)	4.	Chemistry (71)	4.
Mech. Eng. (18)	5.	Mech. Eng. (18)	5.	Mech. Eng. (19)	5.
Chemistry (30)	3.	Chemistry (30)	3.		
Elec. Eng. (7)	2.				
Elec. Eng. (6)	2.				
*Electives Including Thesis.	2.	*Electives Including Thesis.	6.	*Electives Including Thesis.	9.

Chemistry 78 or 79 is taken at the end of the first or second term.

---

*These electives must be approved by the head of the Department of Chemistry, or in case of those students specializing in metallurgical chemistry, by the head of the Department of Metallurgy.

COURSE IN CIVIL ENGINEERING

Among the special fields which are usually included under the title Civil Engineering, are those of bridge engineering, railroad construction and maintenance of way, sanitary engineering, public water supply and irrigation engineering, and other special branches, such as topographic and geodetic surveying.

The course of instruction is designed to provide the foundation upon which all of these specialties are built. The first two years are, therefore, devoted to the fundamental sciences, to drawing, and to mensuration, and afford an excellent short course in surveying for those expecting to become deputy county surveyors, or to engage in private practise as land surveyors.

During the third and fourth years, attention is turned to engineering proper, and the drafting and sciences studied during these years apply directly to the art of construction as practised in each of the specialties of highway, railway, masonry, bridge, sanitary, and hydraulic engineering.

To keep the course in close touch with practise, the department attempts to make each graduate proficient with the instruments of his profession by requiring attendance at the summer surveying camp for two terms of four weeks each, at the end of the second and third years, or submitting suitable experience with some practising engineer in lieu thereof; by means of work in well-equipped laboratories; and by completing a satisfactory thesis on some practical theme. Much valuable training is to be had from suitable thesis work, and students are urged to begin this during their third year, or the vacation following.

The laboratories of the department include facilities for extended work in investigating cements and reinforced concrete, for investigating road materials, and for rating meters and doing other hydrographic work. The remaining laboratories of the college give the student facility in testing other materials of construction, and familiarize him with the elements of steam and electrical engineering practise.

FOR OUTLINE OF FIRST YEAR SEE PAGE 21

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

SECOND YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
Drawing (33) Projections.	3.	Drawing (36) Descriptive Geom.	5.	Drawing (35) Shades, Shadows.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Civil Eng. (30) Surveying.	5.	Civil Eng. (4) Topog. Drawing.	4.	Civil Eng. (32) Railroad Surveying.	5.
Civil Eng. (31) Field Practise.	1.			Civil Eng. (33) Field Practise.	1.
Military Drill	1.	Military Drill	1.	Military Drill	1.

SUMMER COURSE.—Civil Engineering (22) 4 weeks, of 6 days per week. Field work in surveying.

THIRD YEAR

Mechanics (1) Statics.	5.	Mechanics (2) Str'n'th Mat'ls, Kinet.	5.	Mechanics (3) Kinetics, Hydraulics.	5.
Civil Eng. (3) Topog. Surveying.	4.	Civil Eng. (24) Timber Construction.	5.	Civil Eng. (7) Bridge Stresses.	5.
Civil Eng. (16) Roads and Streets.	5.	Civil Eng. (6) Stereotomy.	4.	Architecture (33) Photography.	2.
Astronomy (4) Mathematical.	3.	Astronomy (5) Mathematical.	3.	Astronomy (6) Mathematical.	4.
English (3) Brief-Making.	2.	English (3) Brief-Making.	2.	English (3) Brief-Making.	2.

SUMMER COURSE.—Civil Engineering (23) 4 weeks, of 6 days per week. Field work in advanced surveying.

FOURTH YEAR

Civil Eng. (8) Bridge Designing.	5.	*Civil Eng. (17) Railways.	5.	Civil Eng. (18) Water Supply.	5.
		*Civil Eng. (25) Adv. Bridge Work.	5.	Civil Eng. (10) Sanitary Eng.	5.
		Civil Eng. (14) Cement Testing.	2.		
Civil Eng. (34) Masonry Constr.	3.	Civil Eng. (35) Masonry Structures.	3.		
Elec. Eng. (6 & 7) Lectures and Lab.	4.	Mech. Eng. (17) Laboratory.	3.	Mech. Eng. (25) Laboratory.	5.
Geology (2) General.	5.	Geology (6) Economic.	3.		

THESIS

---

*Students are to elect either Civil Engineering (17) or Civil Engineering (25).

COURSE IN ELECTRICAL ENGINEERING

The object of this course is to give such training as shall enable the graduate to successfully take up practical work in those branches of engineering in which electricity plays the principal part. In general, the training needed for this purpose is similar to that of the mechanical engineer, except that the student is not expected to become expert in all the fields of mechanical engineering, but must have a good knowledge of the whole subject of power generation, transmission, and transformation, especially in its electrical form.

The constantly widening field wherein electrical methods are being adopted is making an ever-increasing demand for the graduates of technical colleges. Among the industries where electricity is coming into use, perhaps none is more far-reaching or important than electric railroading. Furthermore, the substitution of electricity upon steam roads is beginning, and it would be a bold man who would set a limit to the progress of this movement. Akin to the above is the use of electric power for the transmission of material over short distances, as in the case of mines, shop railway cranes, etc. The driving of machine shops by electricity, although it has become the standard method and is being installed in all new shops of importance, has yet a wide field for development. In the telephone industry both the manufacturing and operating companies are calling for technical graduates in ever larger numbers, and the engineering side of this work offers a field than which there is perhaps none more interesting. To the electrical engineering graduate there are opened up several different kinds of work. The manufacturers have long required many men for their engineering, commercial, and manufacturing departments; a newer and large field is now opening up among the operating companies, and there are also positions with construction and commercial companies.

FOR OUTLINE OF FIRST YEAR SEE PAGE 21

Summer Term.—Students are required to take *two* of the following courses in shopwork in the summer term at the close of the first year: Shopwork (4), (7), and (11).

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

SECOND YEAR

First Term		Second Term		Third Term	
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Physics (3) Problems.	2.	Physics (3) Problems.	2.	Physics (3) Problems.	2.
Shop (4, 7, or 11)	3.	Shopwork (13) Machine Work.	3.	Physics (5) Laboratory.	4.
English (3) Brief-Making.	2.	English (3) Brief-Making.	2.	English (3) Brief-Making.	2.
Military Drill	1.	Military Drill	1.	Military Drill	1.

THIRD YEAR

Mechanics (1) Statics.	5.	Mechanics (2) Str'n'th Mat'ls, Kinet.	5.	Mechanics (3) Kinetics, Hydraulics.	5.
Physics (6) Laboratory.	5.	Physics (6) Laboratory.	5.	Mech. Eng. (32) Power Plants.	5.
Physics (4) Elect'y, Magnetism.	3.	Mech. Eng. (37) Mechanism.	4.	Mech. Eng. (28) Laboratory.	2.
Shopwork (14) Machine Work.	3.	Elec. Eng. (8) D. C. Machinery.	4.	Elec. Eng. (9) Laboratory.	4.
Drawing (5) Technical.	3.			Elec. Eng. (15) A. C. Machinery.	2

Elec. Eng. (20), (21), (22), or (23) is taken at the end of the winter term.

FOURTH YEAR

Elec. Eng. (16) A. C. Machinery.	3.	Elec. Eng. (17) A. C. Machinery.	2.	Elec. Eng. (19) Designing.	4.
Elec. Eng. (11) Laboratory.	3.	Elec. Eng. (11) Laboratory.	3.	Elec. Eng. (11) Laboratory.	3.
Mech. Eng. (33) Engines and Boilers.	5.	Elec. Eng. (18) Elec. Design.	3	Elec. Eng. (25) Transmission.	2.
Mech. Eng. (29) Laboratory.	3.	Elec. Eng. (24) Applications.	2.	*Elec. Eng. (26) Railways.	3.
		Mech. Eng. (30) Laboratory.	2.	*Elec. Eng. (27) Telephony.	3.
		Ind. Arts (9) Mach. Design.	2.	*Elec. Eng. (28) Illumination.	3.
**Elective	3-5.	**Elective	3-5.	**Electice	3-5.

Elec. Eng. (20), (21), (22), or (23) is taken at the end of the winter term.

THESIS

*Alternative Course.

**Subject to the approval of the professor of Electrical Engineering.

COURSE IN INDUSTRIAL ARTS

This course is designed for those who may desire to occupy positions in the various branches of manufacture, as practical managers, superintendents, or business men

The growth of engineering brought about its subdivision into many special lines, such as civil, mechanical, electrical, mining, and chemical engineering, and established special training for each. The increase in size, importance, and scope of the manufactures of the country has made it desirable to train young men with reference to the management of manufacturing industries; to so educate them that they can readily learn the treatment or processes in any special line of manufacture, be able to intelligently superintend and to initiate and put into successful operation new industrial enterprises.

With this idea in view, this course has been planned to give the student special training along industrial and business lines, together with a certain amount of general culture. There will be found in this course a large amount of science training by which the processes of manufacture based upon these laws may be more readily understood; practise in the different shops and in drawing, so that a good working knowledge of such operations may be acquired, as well as training given to eye and hand, and power of observation and thought developed along mechanical lines; studies into the principles and methods governing the production of the chief materials of construction, the different mechanical movements and their combinations in machinery, the use of materials in various constructions, electrical machinery and steam power plants, together with laboratory practise; also the relations of capital and labor, the problems of trade, and the conduct of business enterprises.

FOR OUTLINE OF FIRST YEAR SEE PAGE 21

Summer Term.—Shopwork Courses (7) 3 and (11) 3 are to be taken in the summer term at the close of the first year.

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

SECOND YEAR

First Term		Second Term		Third Term	
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect. Magnetism.	3.	Physics (2) Light, Sound.	3.
Physics (3) Problems.	2.	Physics (3) Problems.	2.	Physics (3) Problems.	2.
Mathematics (41)	5.				
Shopwork (3) Foundry.	2.	Shopwork (9) Adv. Pattern M'king.	3.	Shopwork (4) Chipping and Filing.	3.
Economics (33) Ele. of Pol. Econ.	3.	Economics (33) Ele. of Pol. Econ.	3.	Economics (33) Ele. of Pol. Econ.	3.
		Economics (57) American Industries.	3.	Economics (57) American Industries.	3.
Military Drill	1.	Military Drill	1.	Military Drill	1.

THIRD YEAR

Drawing (5) Technical.	3.	Ind. Arts (2) Designing.	3.	Ind. Arts (2) Designing.	3.
Ind. Arts (1) Tools and Machines.	3.	Ind. Arts (1) Tools and Machines.	3.	Ind. Arts (1) Tools and Machines.	3.
Shopwork (13) Machine Work.	3.	Shopwork (14) Machine Work.	3.	Shopwork (15) Machine Work.	3.
Metallurgy (4) Fuels and Iron.	5.	Metallurgy (4) Steel.	2.	Mech. Eng. (32) Power Plants.	5.
Economics (48) Account and Statistics.	2	Economics (48) Account and Statistics.	2.	Economics (48) Account and Statistics.	2.
English (3)	2.	English (3)	2.	English (3)	2.
		Civil Eng. (27) Timber and Masonry.	3.		

FOURTH YEAR

Shopwork (16) Adv. Mach. Work.	3.	Elec. Eng. (6) Lectures.	2.	Shopwork (17) Adv. Mach. Work.	3.
Elec. Eng. (6) Lectures.	2.				
Elec. Eng. (7) Laboratory.	2.	Elec. Eng. (7) Laboratory.	2.	Civil Eng. (21) Surveying.	3.
Ind. Arts (3) Shop Equipment.	3.	Ind. Arts (3) Shop Appliances.	3.	Ind. Arts (3) Shop Management.	3.
Ind. Arts (4) Adv. Designing.	3.	Ind. Arts (4) Adv. Designing.	3.	Ind. Arts (4) Adv. Designing.	3.
Mech. Eng. (12) Laboratory.	2.	Mech. Eng. (29) Laboratory.	2.	Mech. Eng. (30) Laboratory.	2.
Economics (37) Ind. Org'nizat'n, etc.	3.	Economics (38) Ind. Concen., etc.	3.	Economics (39) Lab. Organ., etc.	3.
		Elective	3.		

THESIS

COURSE IN MANUAL TRAINING

This course is designed for those who wish to become teachers of manual training in the public schools of secondary grade or in technical schools. It is necessary that a teacher of manual training in the public schools be of the same high standard as his associates in character, general culture, and uplifting influence. He must possess knowledge of the methods of instruction and ability in the art of teaching; and coupled with these, he must have skill in his technical lines. He must be familiar with the tools, materials, and processes used, and acquainted with the different effects on his pupils of the training and work with these. He must understand that enlarged power and ability in the student is what he is seeking; that the pupil himself and not the inanimate object used is the real product of his efforts.

The value of manual training as a needed factor in the education of modern days is recognized. In the old times, when so many machine-made articles were not in the market, and living was not so diversified, the children of the family received their manual training at their homes and under their parents as teachers. There were the household duties assigned to them and things to be made and repaired and ideas of improvements to be wrought out. These were done with a great deal of hand work, and a valuable training was obtained. Now this training is brought about by the introduction of manual work into the schools from the lowest to the highest grades. In the higher grades the materials used in the manual training are those in common use, wood and iron; and the principles underlying the working of them in the various industries are studied and practised.

As the work is arranged in the course offered, the student is well grounded in the sciences and mathematics, physics, and chemistry, and can plan his manual training work to help more directly the other lines of work of his pupils.

FOR OUTLINE OF FIRST YEAR SEE PAGE 21

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

SECOND YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Physics (3) Problems.	2.	Physics (3) Problems.	2.	Physics (3) Problems.	2.
Shopwork (7) Woodwork.	3.	Shopwork (9) Adv. Pattern M'k'g.	3.	Shopwork (8) Cabinet Work.	3.
Shopwork (3) Foundry.	3.	Shopwork (11) Forging.	3.	Shopwork (12) Adv. Forging.	3.
English (3) Brief-Making.	2.	English (3) Brief-Making, etc.	2.	English (3) Brief-Making, etc.	2.
Education (1) Elem. Psychology.	3.	Education (1) Elem. Psychology.	3.	Education (1) Elem. Psychology.	3.
Military Drill	1.	Military Drill	1.	Military Drill	1.

THIRD YEAR

Drawing (5) Technical.	3.	Ind. Arts (2) Designing.	3.	Ind. Arts (2) Designing.	3.
Ind. Arts (1) Tools and Machines.	3.	Ind. Arts (1) Tools and Machines.	3.	Ind. Arts (1) Tools and Machines.	3.
Shopwork (4) Chipping, Filing.	3.	Shopwork (13) Machine Work.	3.	Shopwork (14) Machine Work.	3.
History (1) U. S. Political.	3.	History (1) U. S. Political.	3.	History (1) U. S. Political.	3.
*Chemistry (20) Quantitative.	4.	*Chemistry (20) Quantitative.	4.	*Chemistry (20) Quantitative.	4.
*Chemistry (21) Physical.	2.	*Chemistry (21) Physical.	2.	*Chemistry (21) Physical.	2.
*Physics (5) Laboratory.	5.	*Physics (5) Laboratory.	5.	*Physics (5) Laboratory.	5.

FOURTH YEAR

Shopwork (15) Adv. Mach. Work.	3.	Shopwork (16) Adv. Machine Work.	3.	Mech. Eng. (32) Power Plants.	5.
Elec. Eng. (6) Lectures.	2.	Elec. Eng. (6) Lectures.	2.	Mech. Eng. (28) Laboratory.	2.
Elec. Eng. (7) Laboratory.	2.	Elec. Eng. (7) Laboratory.	2.		
Education (5) Science of Educ.	3.	Education (5) Science of Educ.	3.	Education (5) Science of Educ.	3.
Polit. Science (1) Pol. Inst. of U. S.	3.				
Electives	2-5.	Electives	5-7.	Electives	5-7.

THESIS

---

*Students take either Chemistry (20) and (21) or Physics (5).

COURSE IN MECHANICAL ENGINEERING

Mechanical engineering deals with the generation of power from the forces of nature and the utilization of this power in machinery by means of mechanism for the manufacture of different products. Physics is the fundamental science underlying this profession, especially those parts of physics relating to mechanics and heat. Chemistry is required for understanding the constitution of the materials used and for the changes which take place during combustion. Mathematics is the tool by which scientific principles are made applicable to practical engineering problems.

One of the great fields of mechanical engineering is the generation of power by means of the steam boiler, steam engine, and steam turbine. The great advances of the past century have been made possible by improvements in these lines. Recently a rival has sprung up for steam; the field of gas engineering, which includes the manufacture and utilization of fuel in gaseous form directly in the engine, will probably furnish sweeping changes in the generation of power. The utilization of water power and the power of the wind also form fields for the mechanical engineer. The application of the power, whatever its manner of generation, can be had either directly by pumps, air compressors, and electrical machinery, or indirectly through shafting, belting, and ropes. These applications furnish other opportunities. The machinery called for and designed by the mechanical engineer includes all that is used in the different industrial establishments, from the large machines found in rolling mills, steel works, and other manufacturing establishments to the delicate machinery used in the manufacture of watches. Still another branch includes such allied subjects as heating, ventilating, and refrigeration.

The training given is designed to equip men with such general and technical knowledge that they can take up the work in any of the branches of the profession.

FOR OUTLINE OF FIRST YEAR SEE PAGE 21

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

SECOND YEAR

SUMMER TERM.—Students are required to take *two* of the following courses in shopwork in the summer term at the close of the first year: Shopwork (4), (7), and (11).

FIRST TERM		SECOND TERM		THIRD TERM	
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Shopwork (3) Foundry.	2.	Physics (7) Laboratory.	2.	Physics (7) Laboratory.	3.
English (3) Brief-Making.	2.	English (3) Brief-Making.	2.	English (3) Brief-Making.	2.
Shopwork (4, 7, 9, or 11)	3.	Shopwork (4, 9, or 11)	3.	Shopwork (13) Machine Work.	3.
Military Drill	1.	Military Drill	1.	Military Drill	1.

THIRD YEAR

Mechanics (1) Statics.	5.	Mechanics (2) Str'n'th Mat'ls, Kinet.	5.	Mechanics (3) Kinetics, Hydraulics.	5.
Mech. Eng. (12) Laboratory.	2.	Mech. Eng. (3) Mechanism.	5.	Mech. Eng. (3) Mechanism.	2.
Drawing (5) Technical.	3.	Civil Eng. (27) Timber. Masonry.	3.	Architecture (33) Photography.	2.
Metallurgy (4) Fuels and Iron.	5.	Metallurgy (4) Steel.	2.	Civil Eng. (19) Trusses.	5.
Shopwork (14) Machine Work.	3.	Shopwork (15) Adv. Machine Work.	4.	Mech. Eng. (32) Power Plants.	5.
Mathematics (11) Diff. Equations.	1.				

Mech. Eng. (38), (39), (40), or (41) is taken at the end of the winter term.

FOURTH YEAR

Mech. Eng. (33) Engines and Boilers.	5.	Mech. Eng. (34) Thermodynamics.	5.	Mech. Eng. (21) Thesis.	5.
Mech. Eng. (27) Laboratory.	5.	Mech. Eng. (14) Laboratory.	4.	Mech. Eng. (15) Laboratory.	3.
Mech. Eng. (18) Machine Design.	5.	Mech. Eng. (18) Machine Design.	5.	Mech. Eng. (19) Machine Design.	5.
Elec. Eng. (6) Lectures.	2.	Elec. Eng. (6) Lectures.	2.	Mech. Eng. (31) Hydraulic Mach.	3.
Elec. Eng. (7) Laboratory.	2.	Elec. Eng. (7) Laboratory.	2.	Ind. Arts (5) Shop Appliances.	3.

THESIS

Mech. Eng. (38), (39), (40), or (41) is taken at the end of the winter term.

COURSE IN MINE ENGINEERING

The profession of mine engineering involves two distinct fields, that of the engineer and that of the metallurgist. A man may devote himself to either of these departments, but a competent understanding of both is essential to the successful designing and development of mining or metallurgical plants.

On the engineering side the work is directed to the excavation and working of mineral resources. In this are involved the geological features of the locality; the opening of the property; the mechanical handling of the ores or coal; the surveying and mapping of the mining operations, and the proper drainage and ventilation of the mine.

In its metallurgical aspects, mine engineering is confined to the reduction of the metals from their ores, the manufacture and alloying of the metals, and the treatment and utilization of fuels from the standpoint of the effective generation of a calorific power rather than the conversion of the power to other forms of energy.

The professional outlook for the mine engineer is good. The development of coal mining has given rise to a considerable demand for trained men to have charge of the engineering work involved and ultimately for the general management of the business. The widely distributed fields for the mining of metallic minerals and the special and somewhat isolated character of many of the plants, make the training of the mine engineer of special importance in their management. In connection with the larger reduction plants, with steel manufacture, and with iron blast furnaces, there is a growing demand for men trained as metallurgical chemists. The industries dealing with the treatment and smelting of ores are growing rapidly and are in need of trained men.

FOR OUTLINE OF FIRST YEAR SEE PAGE 21

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

SECOND YEAR

First Term		Second Term		Third Term	
Drawing (33) Projections.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Caluculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Metallurgy (5) Laboratory.	5.	Metallurgy (5) Laboratory.	5.	Metallurgy (5) Laboratory.	5.
Shopwork (7) Woodwork.	2.	Shopwork (11) Forging.	2.	Metallurgy (2) Mineralogy.	3.
Military Drill	1.	Military Drill	1.	Military Drill	1.

THIRD YEAR

First Term		Second Term		Third Term	
Mechanics (1) Statics.	5.	Mechanics (2) Str'n'th Mat'ls, Kinet.	5.	Mechanics (3) Kinetics, Hydraulics.	5.
Metallurgy (4) Fuels and Iron.	5.	Metallurgy (4) General.	5.	Metallurgy (3) Deter. Mineralogy.	5.
Mine Eng. (4) Mine Surveying.	5.	Metallurgy (6) Assaying.	5.	Civil Eng. (19) Trusses.	5.
English (3) Brief-Making.	2.	English (3) Brief-Making.	2.	English (3) Brief-Making.	2.
		Mine Eng. (7) Surveying.	1.		

FOURTH YEAR

First Term		Second Term		Third Term	
Mine Eng. (5) Mine Engineering.	5.	Mine Eng. (5) Mine Engineering.	5.	Mine Eng. (5) Mine Engineering.	5.
Geology (2) General.	5.	Geology (6) Economic.	3.	Mech. Eng. (36) Laboratory.	5.
Metallurgy (8) Ore Dressing.	2.	Metallurgy (7) Metal Construction.	3.	Mine Eng. (6) Plans and Spec.	5.
Elec. Eng. (6) Lectures.	2.	Elec. Eng. (6) Lectures.	2.	Architecture (33) Photography.	2.
Elec. Eng. (7) Laboratory.	2.	Elec. Eng. (7) Laboratory.	2.		
		Geology (7) Petrography.	2.		

THESIS

COURSES NOT LEADING TO A DEGREE

The following short courses are offered by the University in the belief that they will meet the needs of a large class of young men who for some reason will not or cannot obtain the benefits of the thorough courses already described. The University recognizes that there are many valid reasons which may stand in the way of some, whose ability to receive and to use the highest forms of education is without question; and it is thought that in extending opportunities for such training as will be available to these young men, the University is filling a long felt want in the scheme of engineering education, and is certain to grow into closer contact with the industrial life of the State.

To one completing these courses, a certificate is issued stating the studies in which work has been satisfactorily done.

The requirements for admission to these short courses are very much lower than for admission to regular collegiate work. It is clear that to reach the young men for whom these courses have been designed, it is necessary that the conditions of admission and attendance shall be shorn of every complication and that the opportunity extended shall be within the grasp of all, and with the minimum of formality or restriction.

The somewhat elementary character of some of the work of these courses may attract the attention of some, who as candidates for admission to regular collegiate work, could not be admitted on account of their insufficient preparation. To all such students it is proper to state that these courses are in no sense designed as preparatory schools for those who desire ultimately to enter college, and it is not the purpose to permit such use to be made of them. For the detailed requirements for admission to these short courses see page 18.

SHORT COURSE IN CLAY-WORKING

The two-year course is designed to assist young men who have already been actively engaged in the Ceramic industries, and who, on account of mature years, or lack of means, or lack of previous educational advantages, are unable to avail themselves of the full and complete course, and yet who wish to increase their earning power or chances of promotion by fitting themselves for other than routine labor. This course comes into as close a touch with the wants of the clay industries as is possible in so brief a time. It is intended to make its benefits available to the greatest number.

FIRST YEAR

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

First Term		Second Term		Third Term	
Chemistry (3) Inorganic.	4.	Chemistry (3) Inorganic.	4.	Chemistry (45) Quantitative.	4.
Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.
Mathematics (3) Plane Geom.	5.	Mathematics (13) Space Geom.	5.	Mathematics (14) Trigonometry.	5.
Drawing (2) Lettering.	3.	Drawing ((38) Projections.	3.	Drawing (39) Drafting.	3.
Military Drill	1.	Military Drill	1.	Military Drill	1.
Gymnasium	1.	Gymnasium	1.	Gymnasium	1.

Summer Term—Students are required to take Shopwork (7) and (11) in the summer term at the end of the first year. But they may be excused from this where they are able to obtain positions in some ceramic establishment for the summer; and on presentation of a satisfactory certificate, endorsed by the head of the department, work in a ceramic factory during the summer may be counted as equivalent to the summer shop course.

SECOND YEAR

First Term		Second Term		Third Term	
Ceramics (1) Laboratory.	5.	Ceramics (2) Laboratory.	5.	Ceramics (19) Laboratory.	5.
Ceramics (4) Lectures.	5.	Ceramics (5) Lectures.	5.	Ceramics (6) Lectures.	5.
Physics (1) Elementary.	5.	Physics (1) Elementary.	5.	Ceramics (23) Laboratory.	7.
Ceramics (20) Laboratory.	2.	Ceramics (21) Laboratory.	2.		
Military Drill	1.	Military Drill	1.	Military Drill	1.

SHORT COURSE IN INDUSTRIAL ARTS

This course is designed to benefit those young men who are already employed in manufacturing work and who wish to train themselves for a higher class of work and a more responsible position. It is the custom in shops to put a boy at work on one particular machine or line of work and to keep him at that alone. The bright and ambitious young men desire to be able to do more than that one thing. They want to know how to handle other machines, to read and make shop drawings, to do other parts of the work. They are usually unable to secure such instruction where employed. This course offers opportunity to such men to learn the principles underlying shop work, and to train themselves so that with practise they may increase their ability and earning power. The work is planned for those who may have been deprived of much public school training, and gives in as condensed a form as possible those studies which can most readily be turned to practical account.

FIRST YEAR

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

FIRST TERM		SECOND TERM		THIRD TERM	
Drawing (24) Freehand.	1.	Drawing (25) Freehand.	1.	Drawing (26) Freehand.	1.
Drawing (2) Lettering.	3.	Drawing (38) Projections.	3.	Drawing (39) Drafting.	3.
Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.
Mathematics (3) Plane Geometry.	5.	Mathematics (13) Space Geometry.	5.	Mathematics (14) Trigonometry.	5.
Shopwork (7) Pattern Making.	3.	Shopwork (9) Adv. Pattern M'k'g.	3.	Shopwork (11) Forging.	3.
Military Drill	1.	Military Drill	1.	Military Drill	1.
Gymnasium	1.	Gymnasium	1.	Gymnasium	1.

SECOND YEAR

Ind. Arts (8) Machine Drawing.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Ind. Arts (1) Tools, Machines.	3.	Ind. Arts (1) Tools, Machines.	3.	Ind. Arts (1) Tools, Machines.	3.
Physics (1) Elementary.	5.	Physics (1) Elementary.	5.	Geology (1) Phys. Geography.	5.
Shopwork (4) Clipping, Filing.	3.	Shopwork (13) Machine Work.	3.	Shopwork (14) Adv. Machine Work.	3.
Shopwork (3) Foundry.	2.	Ind. Arts (2) Designing.	3.	Ind. Arts (2) Designing.	3.
Military Drill	1.	Military Drill	1.	Military Drill	1.

SHORT COURSE IN MINING

The short course in mining is especially designed for young men who have had practical experience in mines and wish to study mine surveying, drafting, the problems of ventilation, drainage, haulage, mine operating, etc., and also something of the sciences bearing upon their work, but have neither time nor preparation for a full college course. The first year is devoted to a thorough study of the elementary mathematics and sciences necessary to prepare the student for the practical work of the second year. Experience has shown beyond any doubt that any enterprising young miner can master the subject sufficiently well in the time assigned to materially increase his earning capacity and chances for promotion in his occupation.

Personal instruction is given, and it is made thoroughly practical and of such a character as to best adapt it to the needs of the individual student.

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department, the other figure indicates the number of credit hours.

FIRST YEAR

First Term		Second Term		Third Term	
Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.
Mathematics (3) Geometry.	5.	Mathematics (13) Space Geometry.	5.	Mathematics (14) Trigonometry.	5.
Physics (1) Elementary.	5.	Physics (1) Elementary.	5.	Geology (1) Phys. Geography.	5.
Military Drill	1.	Military Drill	1.	Military Drill	1.
Gymnasium	1.	Gymnasium	1.	Gymnasium	1.

SECOND YEAR

Drawing (2) Lettering.	3.	Drawing (38) Projections.	3.	Drawing (39) Drafting.	3.
Drawing (27) Freehand.	2.	Geology (4) Elementary.	5.	Shopwork (11) Forging.	3.
Chemistry (3) Inorganic.	4.	Chemistry (3) Inorganic.	4.	Metallurgy (9) Mineral Chemistry.	5.
Mine Eng. (1) Mine Surveying.	5.	Mine Eng. (2) Ventilat. Haulage.	5.	Mine Eng. (3) Mine Operating.	5.
		Mine Eng. (7) Surveying.	1.		
Military Drill	1.	Military Drill	1.	Military Drill	1.

DEPARTMENTS OF INSTRUCTION

AMERICAN HISTORY AND POLITICAL SCIENCE

(Office, University Hall, Room 207.)

PROFESSORS KNIGHT, SPENCER, AND MR. DYKSTRA

HISTORY

1. POLITICAL HISTORY OF THE UNITED STATES. Three credit hours. Text-books and prescribed reading. Thwaite's The Colonies, Hart's Formation of the Union, Wilson's Division and Re-Union. Manual Training, third year, first, second and third terms, *M., W., F.,* 8 *or* 9. Mr. DYKSTRA.

POLITICAL SCIENCE

1. CONSTITUTIONAL GOVERNMENT. Three credit hours. Manual Training, fourth year, first term, *M., W., F., at* 9. Prerequisite, American History 1. Professor SPENCER.

Lectures and recitations. This is the first term's work of a course running through the entire year and is a study of the origin and nature of the political institutions of the United States, and an analysis of the form and powers of the government.

ARCHITECTURE

(Office, Room 22, Brown Hall.)

PROFESSOR BRADFORD, ASSISTANT PROFESSOR CHUBB, MR. HASKETT

The department work in Architecture is carried on in Brown Hall. The well-lighted designing rooms are equipped with the needed tables, lockers, etc., and the lecture room is provided with an electric projection lantern. The department has valuable material for consultation and study, including models in plaster and wood illustrating the constructive and ornamental forms of different styles of architecture, photographs and lantern slides, drawings and specifications of erected structures, plates of architectural forms and ornaments, samples of building material. Various structures are continually in process of erection in the city which furnish examples of a practical nature.

4. SPECIFICATIONS. Two credit hours. Architecture, fourth year, second term. *M.*, 1 *to* 5, and assigned work. Prerequisite, Architecture 18. Professor BRADFORD.

Lectures and practise in preparing specifications for architectural structures.

5. DECORATION AND ORNAMENT. Three credit hours. Architecture, third year, first term, *M., F.*, 9 *to* 12. Prerequisite, Drawing 37 and Architecture 14. Assistant Professor CHUBB.

Lectures on the different styles of carved ornament and decorative color.

33. PHOTOGRAPHY. Two credit hours. Architecture, third year, first term; Ceramics, fourth year, first term, *M., Tu.*, 1 *to* 3, *or Th., F.*, 1 *to* 3. Civil and Mechanical Engineering, third year, third term; Mine Engineering, fourth year, third term, *M., Tu.*, 1 *to* 3, *or Th., Fr.*, 1 *to* 3. Prerequisite, Chemistry 7 and Physics 2. Professor BRADFORD, Mr. HASKETT.

9. HISTORY OF ARCHITECTURE. Three credit hours. Architecture, second year, first term, *M., W., F., at* 11. Professor BRADFORD.

Lectures illustrated by lantern slides.

10. Continuation of 9. Architecture, second year, second term, *M., W., F., at* 9. Professor BRADFORD.

11. Continuation of 10. Architecture, second year, third term, *M., W., F., at* 9. Professor BRADFORD.

12. THE ORDERS. Two credit hours. Architecture, second year, first term, *W., Th.*, 1 *to* 3. Concurrent, Drawing 33 and Architecture 9. Assistant Professor CHUBB.

Drawing details of orders, with the special object of impressing upon the student's mind the architectural characteristics considered.

13. ORDER PROBLEMS. Three credit hours. Architecture, second year, second term, *W., Th., F.*, 1 *to* 4. Prerequisite, Architecture 12. Assistant Professor CHUBB.

Course in architectural designing incorporating the different Architectural Orders.

14. Continuation of 13. Three credit hours. Architecture, second year, third term, *W., Th., F.*, 1 *to* 4. Concurrent, Architecture 11. Assistant Professor CHUBB.

15. RESIDENCE ARCHITECTURE. Four credit hours. Lectures and practise. Architecture, third year, first term, *M., Tu., W.*, 1 *to* 4. Prerequisite, Architecture 14, and Drawing 37. Professor BRADFORD.

17. SCHOOL ARCHITECTURE. Four credit hours. Architecture, third year, third term, *M., Tu., W.*, 1 *to* 4. Prerequisite, Architecture 23. Assistant Professor CHUBB.

18. PUBLIC BUILDINGS. Four credit hours. Architecture, fourth year, first term, *Tu., Th.,* 9 *to* 12; *F.,* 1 *to* 4. Prerequisite, Architecture 17. Professor BRADFORD, Assistant Professor CHUBB.

19. ECCLESIASTICAL ARCHITECTURE. Four credit hours. Architecture, fourth year, third term, *M., Tu.,* 1 *to* 5. Prerequisite, Architecture 21. Professor BRADFORD.

20. THESIS. Five credit hours. Architecture, fourth year, third term, *Tu., Th.,* 9 *to* 12; *F.,* 1 *to* 5.

Original design to be accompanied with written description, specifications and estimate.

21. ARCHITECTURE OF TALL SKELETON-CONSTRUCTED BUILDINGS. Four credit hours. Architecture, fourth year, second term, *M.,* 10; *Tu., Th.,* 9 *to* 11; *F.,* 1 *to* 5. Prerequisite, Architecture 18. Professor BRADFORD, Assistant Professor CHUBB.

22. PRINCIPLES OF ARCHITECTURAL COMPOSITION. Two credit hours. Architecture, third year, first term, *Tu., Th., at* 9. Concurrent, Architecture 5. Assistant Professor CHUBB.

23. DESIGNING. Modern apartment houses. Four credit hours. Architecture, third year, second term, *M., Tu., W.,* 1 *to* 4. Prerequisite, Architecture 15. Assistant Professor CHUBB.

24. STRUCTURAL DETAILS. Three credit hours. Architecture, third year, third term, *M., W., F., at* 8. Prerequisite, Architecture 15. Professor BRADFORD.

25. SANITARY PLUMBING. Two credit hours. Architecture, fourth year, first term, *M., W., at* 8. Professor BRADFORD.

Lectures on the principles of sanitary plumbing.

26. ARCHITECTURAL PERSPECTIVE.. Five credit hours. Architecture, second year, third term, *M., F.,* 10; *Tu. Th.,* 9 *to* 12. Assistant Professor CHUBB.

27. ARCHITECTURAL STEREOTOMY. Four credit hours. Architecture, third year, second term, *M., F.,* 9 *to* 12; *W., at* 11. Prerequisite, Drawing, 36. Professor BRADFORD.

Lectures and practise. Arches, vaults, domes, wing walls, stair ramps, etc.

28. ESTIMATING. Two credit hours. Course in Architecture, fourth year, third term, *W., at* 11; *F.,* 10 *to* 12. Professor BRADFORD.

Lectures and practise in preparing the estimated cost of buildings.

29. PROFESSIONAL PRACTISE. Two credit hours. Architecture, fourth year, third term, *Tu., Th., at* 8. Professor BRADFORD.

Lectures on relations of architect and owner, architect and contractor, duties of supervisor of erection, contracts, office practise, etc.

30. MONUMENTAL DESIGN. Three credit hours. Architecture, fourth year, first term, *M., Tu.,* 1 *to* 4. Prerequisite, Architecture 17. Professor BRADFORD, Assistant Professor CHUBB.

31. SUMMER WORK. The equivalent of four weeks of work in an architect's office, eight hours a day. Summer vacation at end of sophomore or junior year.

32. SUMMER WORK. Working up a problem in design, assigned by the department, or a report on summer travel. Summer vacation at end of sophomore or junior year.

ASTRONOMY

(Office, Emerson McMillin Observatory.)

PROFESSOR H. C. LORD, MR. SMITH, MR. MANSON

The Observatory was founded in 1895 through the generosity of Mr. Emerson McMillin. The building and equipment are designed primarily for the purpose of instruction. The aim of the teaching is to give a mastery of the fundamental principles rather than to accumulate a mass of half-understood measurements. Sixteen students can work each clear night under the constant supervision of the instructor, the inconvenience of open air observations being reduced to a minimum.

4. ASTRONOMY, GEODESY, AND LEAST SQUARES. Three credit hours. Civil Engineering, third year, first term. Lectures, *M., W., F., at* 11 *or* 1. Laboratory hours arranged with the students individually. Prerequisite Mathematics 43 and Physics 2. Professor LORD, Mr. MANSON.

Lectures on practical astronomy, supplemented by practise with the instruments of the Emerson McMillin Observatory.

5. Continuation of 4. Three credit hours. Civil Engineering, third year, second term. Lectures, *M., W., F., at* 9 *or* 11. Professor LORD, and Mr. MANSON.

6. Continuation of 5. Laboratory work. Four credit hours. Civil Engineering, third year, third term, *M., W., F., at* 11; *M., Tu.,* 1 *to* 4, *or M., F., at* 10; *W., at* 1; *W., Th.,* 1 *to* 4. Professor LORD, and Mr. MANSON.

CHEMISTRY

(Office, Chemical Hall.)

PROFESSOR MCPHERSON, EMERITUS PROFESSOR NORTON, ASSOCIATE PROFESSORS HENDERSON, FOULK, ASSISTANT PROFESSORS EVANS, WITHROW, MR. VOGT, MR. KNOTE, MR. MORRIS, AND DEPARTMENT FELLOWS

The laboratories of the department accommodate about one thousand students. Each laboratory is equipped with all the necessary conveniences—water, gas, electric lights, distilled water, piped from a large still in the attic; steam ovens, automatic air blasts, suction pumps, etc. The department is liberally supplied with the best apparatus and materials for both lecture room and laboratory work. Each student has his own desk, with drawers and locker. All supplies are procured from the chemical store-room, which has on hand a complete stock of all necessary materials.

3. ELEMENTARY CHEMISTRY. Four credit hours. First and second terms. One lecture, one quiz, six hours laboratory work weekly. Lectures, *M., at* 10; quiz, *Th., at* 8. Laboratory, *M., Tu.,* 1 *to* 4. Asistant Professor EVANS, Assistant Professor WITHROW, Mr. VOGT, Mr. MORRIS, and department fellows.

7. ELEMENTARY CHEMISTRY. Four credit hours. First and second terms. One lecture, one quiz, six hours laboratory work weekly. Lecture, *M., at* 8 *or* 3; quiz, *F., at* 8, 9, 11, 1, *or* 3. Laboratory, *M., F.,* 9 *to* 12; *Tu., Th.,* 9 *to* 12; *M., Tu.,* 1 *to* 4; *Th., F.,* 1 *to* 4. Assistant Professor EVANS, Mr. VOGT, Mr. MORRIS, and department fellows.

This course is arranged for students who have not presented chemistry as an entrance requirement. Students taking this course will follow with course 12, third term.

44. GENERAL CHEMISTRY. Four credit hours. First and second terms. One lecture, one quiz,and six hours laboratory work weekly. Lecture, *W., at* 9; quiz, *F., at* 8 *or* 3. Laboratory, *M., F.,* 9 *to* 12; *Tu., Th.,* 9 *to* 12; *M., Tu.,* 1 *to* 4, *or Th., F.,* 1 *to* 4. Professor MCPHERSON, Associate Professor HENDERSON, Assistant Professor EVANS, Mr. VOGT, Mr. MORRIS, and department fellows.

This course is arranged for students who have had an acceptable course in elementary chemistry in a secondary school. Students taking this course will follow with course 12, the third term.

45. QUALITATIVE ANALYSIS. Four credit hours. Third term. One lecture, one quiz, six hours laboratory work weekly. Prerequisite, Chemistry 3. Time same as Chemistry 3. Assistant Professor EVANS, Assistant Professor WITHROW, Mr. VOGT, Mr. MORRIS, and department fellows.

This is a general elementary course in qualitative analysis, and is arranged for students in short courses only.

12. QUALITATIVE ANALYSIS. Four credit hours. Third term. One lecture, one quiz, six hours laboratory work weekly. Prerequisite, Chemistry 7 or 44. Lecture, *M.*, 8 *or* 3; quiz and laboratory at same time as Chemistry 7. Assistant Professor EVANS, Assistant Professor WITHROW, Mr. VOGT, Mr. MORRIS, and department fellows.

This is a general introductory course in qualitative analysis.

21. ADVANCED GENERAL CHEMISTRY. Two credit hours. First, second, and third terms. Two lectures weekly. *Tu., Th., at* 9. Prerequisite, Chemistry 7 or 44. Associate Professor HENDERSON.

This course consists of reviews and extends the work in general chemistry.

20. QUANTITATIVE ANALYSIS. Four credit hours. First, second, and third terms. One lecture, nine hours laboratory work weekly. Lecture, *M., Tu., W.*, 1 *to* 4. Laboratory open afternoons. Prerequisite, Chemistry 12 or 37. Associate Professor FOULK, Mr. KNOTE.

First principles of gravimetric and volumetric analysis. This course must be accompanied by Chemistry 40, except by special permission of the instructor. It is also desirable that it should be accompanied by Chemistry 21.

40. CHEMICAL PROBLEMS. One credit hour. First and second terms. *Th., at* 11. Associate Professor FOULK.

Extended practise in the solution of chemical problems pertaining to analytical chemistry. This course is arranged to accompany Chemistry 20.

46. ORGANIC CHEMISTRY. Two credit hours. First, second, and third terms. Two lectures weekly. *Tu., Th., at* 8. Prerequisite, courses 20, and 21, except by special permission of the instructor. Professor MCPHERSON.

General course in organic chemistry. Whenever possible this course should be accompanied by Chemistry 47.

47. ORGANIC CHEMISTRY. Two or three credit hours. First, second, and third terms. Six or nine hours laboratory work weekly. Laboratory open afternoons. Professor MCPHERSON.

Preparation of typical organic compounds. This course must be accompanied or preceded by course 46.

15. SANITARY ANALYSIS. Four credit hours. Second term. Two lectures, four hours laboratory work weekly. Lectures, *Tu., Th., at* 10. Laboratory open afternoons. Prerequisite, Chemistry 20. Associate Professor FOULK.

A study of the methods of sanitary water analysis and the interpretation of results.

30. PHYSICAL CHEMISTRY. Three credit hours. First and second terms. *M., W., F., at* 8. Prerequisite, Chemistry 20, 21; also course 46, except by special permission of the instructor. Ceramics, third year, second term, *M., W., F., at* 8. Associate Professor HENDERSON.

A general course in the theory of chemistry.

32. INDUSTRIAL CHEMISTRY. Four credit hours. First and second terms. Two lectures, six hours laboratory work weekly. *Tu., Th., at* 8. Laboratory, *W., Th.,* 1 *to* 4. Prerequisite, Chemistry 20, 21, 46, 47. Assistant Professor WITHROW.

Industrial applications of chemistry.

71. TECHNICAL ANALYSIS. Four credit hours. Third term. One lecture, nine hours laboratory work weekly. Lecture, *Tu., at* 11. Laboratory open afternoons. Prerequisite, course 20. Associate Professor FOULK.

The chemical examination of various commercial products.

77. THE READING OF CHEMICAL LITERATURE. Two credit hours. First term. Time to be arranged. Prerequisite, German 1. Associate Professor FOULK.

The main object of this course is to afford practise in the rapid reading of German chemical literature, the selections being made with special reference to the technical terms of the science.

78. INDUSTRIAL INSPECTION TRIPS. A four to six days excursion taken at a suitable time in connection with Chemistry 32 for the inspection of industrial chemical processes in actual operation. The entire expense varies from $15 to $30. A satisfactory written report on the work inspected is required.

79. WRITTEN REPORTS. A course of assigned reading upon some industrial chemical process upon which a written report must be made as a substitute for Course 78, upon presentation of reasons satisfactory to the head of the department.

CIVIL ENGINEERING

(Office, Brown Hall, Room 33.)

PROFESSOR SHERMAN, PROFESSOR ENO, ASSOCIATE PROFESSOR MORRIS, ASSISTANT PROFESSOR SCHLAFLY, MR. CHAMRERLIN, MR. WARD.

The department is housed in Brown Hall. For drafting, three spacious and well-lighted drawing rooms are provided for the work of the second, third, and fourth-year students respectively. In each room is a collection of working drawings, prints, maps, etc., gathered from practising engineers, and arranged in suitable file-cases for the ready consultation of the students. A large blue-print room on the ground floor is equipped with electrical blue-print apparatus, in addition to the ordinary sunlight frames.

For field work the instruments are one high-grade transit, seventeen other transits fitted for various kinds of surveying, twelve leveling instruments, plane table, solar compass, two solar attachments, two high-grade aneroid barometers, two drainage levels, surveying camera, rods, chains, tapes, hand-levels, etc. Two current meters with accessories, and a rating course 175 feet long in the rear of the building furnish facilities for carrying on hydrographic work.

The cement-testing laboratory is fitted with necessary appliances for making the ordinary tests. It contains a Fairbanks tensile testing machine, briquette molds, sieves, apparatus for making hot tests, etc., and machine for testing plain and reinforced concrete beams.

The department also owns a complete outfit for carrying on the work of summer surveying in camp. Summer camp for 1905 was pitched in Yellowstone National Park, where the classes were engaged in surveying the road system. Summer camp for 1907 was pitched at Willoughby, Ohio, where the students made surveys for street improvements, and for inventory plats of the C., P. & E. electric railway.

3. TOPOGRAPHIC SURVEYING. Four credit hours. Lectures, field work, and drawing. Johnson's Surveying used for reference. Civil Engineering, third year, first term, *M., F., at* 10; *Tu., Th.,* 1 *to* 4; *S.,* 8 *to* 11; *or Tu., Th., at* 10; *M., W., F.,* 1 *to* 4. Prerequisite, Civil Engineering 32 and 22. Assistant Professor SCHAFLY, Mr. CHAMBERLIN.

4. TOPOGRAPHICAL DRAWING. Four credit hours. Platting, pen and tinted work. Reed's Topographic Drawing and Sketching. Civil Engineering, second year, second term, *M., Tu.,* 1 *to* 4; *W.,* 1 *to* 3, *or Th., F.,* 2 *to* 4; *S.,* 8 *to* 12. Prerequisite, Drawing 26 and 32. Professor SHERMAN, Professor ENO.

6. STEREOTOMY. Four credit hours. Recitations, lectures, and drawing. Warren's Stereotomy. Civil Engineering, third year, second term, *M., F., at* 10; *S.,* 8 *to* 12, *or Tu., Th., at* 10; *S.,* 8 *to* 12. Prerequisite, Drawing 36. Professor SHERMAN, Assistant Professor SCHLAFLY, Mr. CHAMBERLIN.

7. BRIDGE STRESSES. Five credit hours. Recitations and lectures, Heller's Stresses in Structures. Civil Engineering, third year, third term, *M., Tu., W., Th., F.,* 8 *or* 9. Prerequisite, Mechanics 2. Associate Professor MORRIS.

8. BRIDGE DESIGNING. Five credit hours. Lectures and drawings. Morris's Notes and Johnson's Modern Framed Structures used for reference. Civil Engineering, fourth year, first term, *M., Tu., W., Th., F., at* 8, *or* 9. Prerequisite, Civil Engineering 7. Associate Professor MORRIS.

10. SANITARY ENGINEERING. Five credit hours. Recitations and lectures. Folwell's Sewerage. Civil Engineering, fourth year, third term, *M., Tu., W., Th., F., at* 9. Prerequisite, Civil Engineering 34. Professor ENO.

14. CIVIL ENGINEERING LABORATORY. Two credit hours. Civil Engineering, fourth year, second term, *M.,* 1 *to* 4; *Tu., at* 1, *or Tu.,* 1 *to* 4; *W., at* 1. Prerequisite, Civil Engineering 34. Professor ENO, Mr. WARD.

Cement testing and adjustment of instruments.

16. HIGHWAYS. Five credit hours. Recitations and lectures. Baker's Roads and Pavements. Civil Engineering, third year, first term. *M., Tu., W., Th., F., at* 8 *or* 9. Prerequisite, Civil Engineering 32. Professor ENO.

17. RAILWAY LOCATION. Five credit hours. Recitations and lectures. Wellington's Economic Theory of Railway Location. Option, Civil Engineering, fourth year, second term, *M., Tu., W.,*

Th., F., at 9. Prerequisite, Civil Engineering 34. Professor Sherman.

18. Water Supply. Five credit hours. Recitations and lectures. Turneaure and Russell's Public Water Supplies. Civil Engineering, fourth year, third term, *M., Tu., W., Th., F., at* 8. Prerequisite, Civil Engineering 34. Professor Eno.

19. Trusses. Five credit hours. Lectures and drawings. Ceramics, fourth year, second term, *M., Tu., W., Th., F., at* 9. Architecture, Mining, and Mechanical Engineering, third year, third term, *M., Tu., Th., F., at* 10; *W., at* 2; *or M., Tu., W., Th., F., at* 11. Prerequisite, Mechanics 2. Associate Professor Morris.

21. Surveying. Three credit hours. Architecture and Industrial Arts, fourth year, third term, *M., W., F., at* 9. Prerequisite, Drawing 32 and Mathematics 14 or 32. Mr. Chamberlin, Mr. Ward.

Recitations, lectures, and field work.

22. Summer Field Work. At conclusion of second year of course in Civil Engineering. Prerequisite, Civil Engineering 32 and 4. Professor Sherman, Professor Eno, Assistant Professor Schlafly, Mr. Chamberlin, Mr. Ward.

The students are taken into camp in a rough, broken country and given a thorough drill in elementary surveying. The course begins the Friday before Commencement Day, and continues four weeks of six days per week, ten hours per day. The work of the student and discipline of the camp is in the hands of competent instructors.

23. Advanced Summer Field Work. Similar to 22. At conclusion of third year of Course in Civil Engineering. Prerequisite, Civil Engineering, 3, 22, and 24.

24. Timber Construction. Five credit hours. Civil Engineering, third year, second term, *M., Tu., W.,* 1 *to* 5; *or W., Th., F.,* 1 *to* 5. Prerequisite, Drawing 35 and Mechanics 1. Assistant Professor Schlafly, Mr. Chamberlin.

25. Advanced Bridge Work. Five credit hours. Draw-spans, continuous girders, steel arches, etc. Option, Civil Engineering, fourth year, second term, *M., Tu., W., Th., F., at* 8. Prerequisite, Civil Engineering 8. Associate Professor Morris.

27. Timber and Masonry. Three credit hours. Industrial Arts and Mechanical Engineering, third year, last three-fifths of second term, *M., Tu., W., Th., F., at* 9. Concurrent, Industrial Arts 4 or Mechanics 2. Assistant Professor Schlafly.

Lectures and recitations. Use of stone, brick, lime, cement, timber, etc., in engineering structures.

28. STEEL CONSTRUCTION. Five credit hours. Architecture, fourth year, second term, *M., Tu., W., Th., F., at* 11. Prerequisite, Civil Engineering 19. Associate Professor MORRIS.

Steel skeleton construction for tall buildings.

29. CEMENT TESTING. Three credit hours. Architecture, fourth year, second term, *Tu., W.,* 1 *to* 4. Prerequisite, Civil Engineering 34. Professor ENO, Mr. WARD.

30. SURVEYING. Five credit hours. Civil Engineering, second year, first term, *M., Tu., W., Th., F., at* 8 *or* 11. Prerequisite, Mathematics 14 or 32. Professors SHERMAN, ENO, Assistant Professor SCHLAFLY, Mr. CHAMBERLIN, Mr. WARD.

Recitations and lectures. Use and adjustment of instruments; farm, city, and hydrographic surveying, and leveling.

31. FIELD PRACTISE IN SURVEYING. One credit hour. Civil Engineering, second year, first term. Concurrent Civil Engineering 30.

32. RAILROAD SURVEYING. Five credit hours. Civil Engineering, second year, third term, *M., Tu., W., Th., F., at* 8 *or* 11. Prerequisite, Civil Engineering 30 and 31. Professors SHERMAN, ENO, Assistant Professor SCHLAFLY, Mr. CHAMBERLIN, Mr. WARD.

Simple and compound curves, spirals, frogs, and switches, and earthwork.

32. FIELD PRACTISE IN RAILROAD SURVEYING. One credit hour. Civil Engineering, second year, third term. Concurrent Civil Engineering 32.

34. MASONRY CONSTRUCTION. Three credit hours. Civil Engineering and Architecture, fourth year, first term, *M., W., F., at* 8 *or* 9. Prerequisite, Mechanics 2. Professor SHERMAN.

Recitations and lectures. Baker's Masonry Construction used as a text.

35. MASONRY STRUCTURES. Three credit hours. Civil Engineering, fourth year, second term, *M., Tu., Th., at* 10. Prerequisite, Civil Engineering 34. Professor SHERMAN.

Lectures and recitations, and drawing, designing of masonry structures. Baker's Masonry Construction, and various standard plans used for reference.

CLAY WORKING AND CERAMICS

(Office, School of Mines Building.)

PROFESSOR ORTON, ASSISTANT PROFESSOR PURDY, MR. KNOTE, MR. WORCESTER

The equipment of the department is exceptional; it was provided by special act of the State Legislature, and has been extended by many valuable gifts and purchases. It is situated in the new School of Mines building, which has recently been built and equipped at a cost of about $110,000. The floor space occupied by the Ceramic Department is about 14,000 square feet. The equipment comprises a chemical laboratory, a physical testing room, a stock and preparation room, a pottery laboratory, a machine room, chiefly devoted to grinding materials and manufacturing and testing structural materials, bricks, etc., a kiln room, two lecture rooms, a museum of ceramic materials and products, and library facilities unusually complete on the technical side.

The department is also much assisted by the co-operation of clay and cement manufacturers who have afforded opportunities for experimental work in their plants, and by the National Brick Manufacturers' Association, which maintains a paid scholarship for research in their industry.

1. Ceramic Chemistry. Five credit hours. Ceramics and Short Clay-working, second year, first term. *M., Tu., W.,* 1 *to* 4. Prerequisite, Chemistry 12 or 45. Assistant Professor Purdy, and Mr. Knote.

Quantitative analysis of salts, lime stone, and simple minerals.

2. Continuation of 1. Five credit hours. Ceramics and Short Clay-working, second year, second term. *M., Tu., W.,* 1 *to* 4. Assistant Professor Purdy, and Mr. Knote.

Quantitative analysis of clays and similar minerals; first, samples of known composition; later, unknown materials.

3. Continuation of 2. Three credit hours. Ceramics, second year, third term. *M., Tu., W.,* 1 *to* 4. Assistant Professor Purdy, and Mr. Knote.

Completion of the ultimate analysis of clays; the proximate or "Rational" analysis of clays and pottery bodies.

4. CLAY MANUFACTURE. Five credit hours. Ceramics, third year, first term; Short Clay-working, second year, first term. *M., Tu., W., Th., F., at* 8. Concurrent, Ceramics 1. Professor ORTON.

The origin, composition, and properties of clays and other minerals employed in the clay, glass, and cement industries.

5. Continuation of 4. Five credit hours. Ceramics, third year; Short Clay-working, second year, second term. *M., Tu., W., Th., F., at* 9. Professor ORTON.

General principles of the manufacture of clay wares, including the selection and winning of the materials, their preparation, manufacture, and drying.

6. Continuation of 5. Five credit hours. Ceramics, third year; Short Clay-working, second year, third term. *M., Tu., W., Th., F., at* 9. Professor ORTON.

Burning and decoration of claywares, including the preparation of coloring materials, glazes, etc.

9. LABORATORY WORK IN CERAMICS. Five credit hours. Ceramics, fourth year, first term. *W., Th., F.,* 1 *to* 4. Prerequisite, Ceramics 3 and 6. Professor ORTON, Mr. WORCESTER.

Practise in clay testing and measurement of the physical properties of clays; the production of bodies made from single clays, from the blending of two or more natural clays, and from clays and minerals other than clays. In each case the bodies made are burnt and tested.

10. Continuation of 9. Five credit hours. Ceramics, fourth year, second term. *M., W., F.,* 1 *to* 4. Professor ORTON, Mr. WORCESTER.

The production of glasses and glazes, beginning with the soft raw-lead glazes, the fritted lead-boracic-acid glazes, and the hard-fire leadless porcelain glazes. In each case the glazes are made for use on some definite body.

11. Continuation of 10. Five credit hours. Alternative with Ceramics 12. Ceramics, fourth year, third term. *M., W., F.,* 1 *to* 4. Professor ORTON, Mr. WORCESTER.

Practise in the use of the coloring and opacifying oxides in glazes, and in the production of colors and body stains for the decoration of pottery.

12. CEMENT MANUFACTURE. Five credit hours. Alternative with Ceramics 11. Ceramics, fourth year, third term. *M., Tu., W., Th., F., at* 8. Prerequisite, Ceramics 3 and 6. Assistant Professor PURDY.

The theory of hydraulicity, the compounding, manufacture, and testing of natural and Portland cements and hydraulic silicates.

15. THESIS.

18. CEMENT MANUFACTURE. Five credit hours. Elective course. Laboratory. Time to be arranged. Prerequisite, Ceramics 12. Assistant Professor PURDY.

Training in the analysis of cement materials by the methods in technical use; in the preparation of minerals for cement; in the burning of cement; in the testing of the products, and in the investigation of the general problems of the cement manufacture.

19. STOICHIOMETRY. Five credit hours. Short Clay-working, second year, third term. *M., Tu., W., Th., F., at* 11. Prerequisite, Ceramics 1 and 2. Assistant Professor PURDY.

Calculation of bodies and glazes and the combustion of the fuel necessary for work in driers and kilns.

20. LABORATORY WORK IN CERAMICS. Two credit hours. Short Clay-working, second year, first term. *Th., F.,* 1 *to* 4. Prerequisite, Chemistry 45. Concurrent, Ceramics 1. Professor ORTON, Mr. WORCESTER.

Testing of clays and minerals employed in clay manufacture.

21. LABORATORY WORK IN CERAMICS. Two credit hours. Short Clay-working, second year, second term, *Th., F.,* 1 *to* 4. Prerequisite, Ceramics 20. Professor ORTON, Mr. WORCESTER.

Compounding of artificial clay bodies and the blending of natural clays.

23. LABORATORY WORK IN CERAMICS. Seven credit hours. Short Clay-working, second year, third term. *M., Tu., W., Th., F.,* 1 *to* 4. Prerequisite, Ceramics 2 and 5. Professor ORTON, Mr. WORCESTER.

The production of glazes of the types commonly used in the pottery and allied industries. Practise will be given in fitting glazes to some definite body.

24. CERAMIC CALCULATIONS. Two credit hours. Ceramics, second year, third term. *Tu., Th., at* 10. Prerequisite, Ceramics 2. Concurrent, Ceramics 3. Assistant Professor PURDY.

Elementary calculations in the calculation of the composition of silicate mixtures, from formulæ and from percents, the results of the natural carolysis of clay bodies, and simple glaze formulæ.

25. CLASSIFICATION AND IDENTIFICATION OF CLAYS. Two credit hours. Ceramics, third year, second term, *Tu.,* 1 *to* 4; *S.,* 8 *to* 11. Prerequisite, Ceramics 4. Concurrent, Ceramics 5. Professor ORTON, Mr. WORCESTER.

Studies on hand specimens of typical clays and clay forming minerals, and their identification by simple tests.

26. PHYSICAL AND CHEMICAL MEASUREMENTS OF CLAYS. Five credit hours. Ceramics, third year, third term, *W., Th., F.,* 1 *to* 4.

Prerequisite, Chemistry 30, Physics 2 and 3, and Ceramics 5. Assistant Professor PURDY.

The application to ceramics of the principles of physical chemistry, especially the phase rule, the studies of eutectics, melting point, pyrometry, calibration of instruments, etc.

DRAWING

(See Engineering Drawing.)

ECONOMICS AND SOCIOLOGY

(Office Room 211, University Hall.)

PROFESSOR HAGERTY, PRESIDENT THOMPSON, ASSOCIATE PROFESSOR HAMMOND, ASSISTANT PROFESSOR MCKENZIE

ECONOMICS

33. ELEMENTS OF POLITICAL ECONOMY. Three credit hours. Not open to first-year students. Industrial Arts, second year, three terms. *M., W., F., at* 8. Other Sections, *M., W., F.,* 9 *and* 11. Professor HAGERTY, Associate Professor HAMMOND.

A careful study of the laws of production, exchange, distribution, and consumption of wealth; combined with an anlaysis of the industrial actions of men as regards land, labor, capital, money, credit, rent, interest, wages, etc. Text-books, lectures, and individual investigations.

*37. INDUSTRIAL ORGANIZATION. Three credit hours. Industrial Arts, fourth year, first term, *M., W., F., at* 9. Prerequisite, Economics 33. Associate Professor HAMMOND.

*38. CORPORATION ORGANIZATION AND FINANCE. Three credit hours. Industrial Arts, fourth year, second term. *M., W., F., at* 9. Prerequisite, Economics 37. Associate Professor HAMMOND.

*51. THE MONOPOLY PROBLEM. Three credit hours. Industrial Arts, fourth year, third term. *M., W., F., at* 9. Prerequisite, Economics 38. Associate Professor HAMMOND.

48. ACCOUNTING AND STATISTICS. Two credit hours. Industrial Arts, third year, first, second, and third terms. *Tu., Th., at* 9.

*57. AMERICAN INDUSTRIES. Three credit hours. Industrial Arts, second and third terms. *M., W., F., at* 2. Prerequisite, 33. Assistant Professor DUNCAN.

---

*Not given in 1908-1909.

ELECTRICAL ENGINEERING

(Office, Engineering Laboratory, Room 152.)

PROFESSOR CALDWELL, ASSOCIATE PROFESSOR ANDEREGG, ASSISTANT PROFESSOR HUNT

This department has excellent facilities for practical experimental work with dynamo machinery and other electrical apparatus. The equipment includes twenty-five dynamo machines of various makes and sizes from 40-H. P. down, aggregating over 250 horse-power, among them 110 and 500 volt direct and alternating current generators, railway and stationary motors, polyphase motors, and three rotary converters specially designed for experimental work. There are also a number of transformers of different makes, including one for welding, one for very high voltage and six of special design for testing. Arc lamps of different styles, a storage battery, condensers, inductance coils, resistances, circuit breakers and apparatus for magnetic testing, illumination testing and photometric work also form part of the equipment. The measuring instruments include about 75 voltmeters, ammeters, and wattmeters. The telephone laboratory has apparatus for comparative tests, a variety of transmitters and receivers, and material illustrative of switch-board practise. The calibration room is well equipped for standardization work.

Power is supplied from the University plant by five induction motors and two synchronous motors or converters. There is also a well-selected and growing collection of photographs, blue-prints, and material, illustrative of electrical manufacture. The library is especially valuable on account of the completeness of its sets of periodicals and transactions. The University power plant is useful as illustrative of a model installation.

6. ELECTRICAL ENGINEERING. Two credit hours. Mechanical, Mine Engineering, Industrial Arts, and Manual Training, fourth year, first and second terms; Civil and Chemical Engineering, fourth

year, first term. *M., Th., or Tu., F., at* 10. Prerequisite, Physics 2. Associate Professor ANDEREGG.

Lectures on direct and alternating circuits, dynamo machinery, transformers, accumulators and their applications.

7. ELECTRICAL ENGINEERING. Two credit hours. Laboratory work on the subjects treated in 6. Fourth year. Associate Professor ANDEREGG, Assistant Professor HUNT.

FIRST TERM

M., 1 *to* 5. Chemical Engineering.
W., or F., 1 *to* 5. Civil Engineering.
M., 1 *to* 5. Industrial Arts.
M., 1 *to* 5. Manual Training.
W., 1 *to* 5; *or S.,* 8 *to* 12. Mechanical Engineering.

SECOND TERM

M., 1 *to* 5. Mine Engineering.
M., 1 *to* 5. Industrial Arts.
M., 1 *to* 5. Manual Training.
F., 1 *to* 5; *or S.,* 8 *to* 12. Mechanical Engineering.

8. DIRECT CURRENT DYNAMO MACHINERY. Four credit hours. Electrical Engineering, third year, second term. *M., Tu., Th., F., at* 9. Prerequisite, Physics 4. Mechanics 1. Concurrent, Physics 6. Associate Professor ANDEREGG.

Generators and motors, their theory, construction, and operation. Lectures, recitations and problems.

9. ELEMENTARY DYNAMO LABORATORY. Four credit hours. Electrical Engineering, third year, third term. *W., Th.,* 1 *to* 5; *or F.,* 1 *to* 5; *S.,* 8 *to* 12. Prerequisite, Electrical Engineering 8. Associate Professor ANDEREGG, Assistant Professor HUNT.

Handling and testing of circuits, generators, motors, etc.

11. ADVANCED DYNAMO LABORATORY. Three credit hours. Electrical Engineering, fourth year, first and second terms, *Tu., or Th.,* 10 *to* 5; third term, *M., or Tu.,* 10 *to* 5. Prerequisite Electrical Engineering 15. Concurrent, 16 and 17. Professor CALDWELL, Assistant Professor HUNT.

Alternating current, railway and telephone apparatus, accumulators, illumination, etc.

15. ALTERNATING CURRENT CIRCUITS AND MACHINERY. Two credit hours. Electrical Engineering, third year, third term. *M., Th., at* 10. Concurrent, Electrical Engineering 9. Professor CALDWELL.

General principles, circuits, generators, and transformers.

16. Continuation of 15. Three credit hours. Electrical Engineering, fourth year, first term. *M., W., F., at* 11. Concurrent, Electrical Engineering 11. Professor CALDWELL.

Transformers, synchronous and induction motors, etc.

17. Continuation of 16. Two credit hours. Electrical Engineering, fourth year, second term. *M., W., at* 8. Concurrent, Electrical Engineering 11. Professor CALDWELL.

18. ELECTRICAL DESIGN. Three credit hours. Electrical Engineering, fourth year, second term. *F.,* 1 *to* 4; *S.,* 8 *to* 11. Prerequisite, Drawing 5. Concurrent, Industrial Arts 9. Assistant Professor HUNT.

Direct and alternating current generators, transformers.

19. Continuation of 18. Four credit hours. Electrical Engineering, fourth year, third term. *Th., F.,* 1 *to* 5. Assistant Professor HUNT.

20. INSPECTION TRIP TO THE EAST. Given only in the even years. Electrical Engineering, third or fourth year.

Includes Pittsburg, Buffalo, Niagara and Cleveland; is taken at the end of the winter term and occupies six days. The entire expense need not exceed $30.00. A satisfactory written report upon the work of the trip is required.

21. INSPECTION TRIP TO THE WEST. Given only in the odd years. Electrical Engineering, fourth or third year.

Includes Chicago, Milwaukee, Cincinnati, and possibly other places; is taken at the end of the winter term, and occupies six days. The entire expense need not exceed $30.00. A satisfactory written report on the work of the trip is required.

22. READING COURSE. Electrical Engineering, third or fourth year; this may be taken as a substitute for 20, on presentation of reasons satisfactory to the head of the department.

Course of assigned reading upon processes of manufacture and power plants.

23. Similar to 22. A substitute for 21.

24. APPLICATIONS OF ELECTRICITY. Two credit hours. Electrical Engineering, fourth year, second term. *Tu., Th., at* 8. Prerequisite, Electrical Engineering 8. Professor CALDWELL, Associate Professor ANDEREGG.

Brief treatment of the elements of illumination, railway work, telephone, mining, etc.

25. ELECTRICAL TRANSMISSION AND DISTRIBUTION. Two credit hours. Electrical Engineering, fourth year, third term. *Tu., Th., at* 8. Prerequisite, Electrical Engineering 8. Professor CALDWELL.

Systems, apparatus, and operation.

26. ELECTRICAL RAILWAYS. Three credit hours. Electrical Engineering, fourth year, third term. *M., W., F., at* 8. Alternative with courses 27 and 28. Prerequisites, Electrical Engineering 17 and 24. Professor CALDWELL.

Including principles of general design, transmission and distribution systems, cars, motors, and operation.

27. TELEPHONY. Three credit hours. Electrical Engineering, fourth year, third term. *M., W., F., at* 9. Alternative with courses 25 and 28. Prerequisite, Electrical Engineering 17 and 24. Associate Professor ANDEREGG.

Methods of operation. Simple circuits and apparatus. Elements of transmission theory.

28. ELECTRIC ILLUMINATION. Three credit hours. Electrical Engineering, fourth year, third term. *Tu., Th., at* 9; *F., at* 10. Alternative with 26 and 27. Prerequisite, Electrical Engineering 17 and 24. Professor CALDWELL.

Principles of illumination, electric lamps, wiring plans, etc.

ENGINEERING DRAWING

(Office, Brown Hall, Room 42.)

PROFESSOR FRENCH, ASSISTANT PROFESSOR LEWIS, MR. TIDBALL, MR. ROGERS, MR. MEIKLEJOHN, MR. BOTT, MR. NORRIS

Mechanical drawing is taught in Brown Hall. For the mechanical drawing there are four large, well-lighted drafting rooms with necessary tables and lockers, and two lecture rooms equipped with electric projection lanterns. A set of Schroeder models and a collection of show drawings are available. There are two blue-print rooms, one provided with an Elliott electric light printing machine, the other with sun frames.

The freehand drawing, painting, and modeling are carried on in Hayes Hall. The rooms are equipped with the usual tables, models and casts, easels, modeling tools, and other needed apparatus.

2. LETTERING. Practise and occasional lectures. Three credit hours. Short Clay-working and Industrial Arts, first year; Short Mining, second year, first term, *Th., F.,* 1 *to* 4. Concurrent, Drawing 24 or 27. Mr. MEIKLEJOHN.

5. TECHNICAL DRAWING. Three credit hours. Electrical and Mechanical Engineering, Industrial Arts and Manual Training, third year, first term, *M., Tu.,* 1 *to* 4, *or Th., F.,* 1 *to* 4. Prerequisite, Drawing 35. Professor FRENCH, Mr. ROGERS.

Rules and methods for making working drawings in machine design to represent correctly form and dimensions for shop use, and for tracing and blue-printing the same.

14. PEN DRAWING. Two credit hours. Architecture, second year, second and third terms, *M., Tu.,* 1 *to* 3. Prerequisite, Drawing 26. Mr. NORRIS.

18. WATER COLOR PAINTING. Two credit hours. Architecture, third year, second term, *Tu., Th.,* 9 *to* 11. Prerequisite, Drawing 26. Mr. NORRIS.

19. WATER COLOR PAINTING. Two credit hours. Architecture, third year, third term, *Tu., Th.,* 8 *to* 10. Prerequisite, Drawing 18. Mr. NORRIS.

21. TECHNICAL DRAWING. Two credit hours. Chemical Engineering, third year, first term, *W.,* 1 *to* 3; *S.,* 8 *to* 10. Mr. ROGERS.

22. TECHNICAL DRAWING. Two credit hours. Chemical Engineering, third year; Ceramics, fourth year, second term, *S.,* 8 *to* 12. Prerequisite, Drawing 21 or 39. Professor FRENCH.

23. TECHNICAL DRAWING. Two credit hours. Chemical Engineering, third year; Ceramics, fourth year, third term, *S.,* 8 *to* 12. Prerequisite, Drawing 22. Professor FRENCH.

24. FREE HAND DRAWING. One credit hour. Short Industrial Arts, first year, first term, *W.,* 1 *to* 3. Mr. TIDBALL.

Pencil drawing from models and plaster casts. Practise and occasional lectures.

25. FREE HAND DRAWING. One credit hour. Short Industrial Arts, first year, second term, *W.,* 1 *to* 3. All four-year courses, first year, second term. Prerequisite, Drawing 24 or 27. Assistant Professor LEWIS, Mr. TIDBALL, Mr. NORRIS.

Brush work from models and plaster casts. Practise and occasional lectures.

26. FREE HAND DRAWING. One credit hour. Short Industrial Arts, first year, third term, *W.,* 1 *to* 3. All four-year courses, first year, third term. Prerequisite, Drawing 25. Assistant Professor LEWIS, Mr. TIDBALL, Mr. NORRIS.

Brush work from plaster casts and still-life. Practise and occasional lectures.

27. FREE HAND DRAWING. Two credit hours. Short Mining, Arts, first year, second term, *W.,* 1 *to* 3. All four-year courses, first

year, first term. Assistant Professor LEWIS, Mr. TIDBALL, Mr. NORRIS.

Pencil drawing from models and plaster casts. Practise and occasional lectures.

31. GEOMETRIC DRAWING. One credit hour. Practise in the use of drawing instruments. All four-year courses, first year, second term. Professor FRENCH, Mr. ROGERS, Mr. MEIKLEJOHN, Mr. BOTT.

32. LETTERING. Two credit hours. Practise and occasional lectures. All four-year courses, first year, third term. Prerequisite, Drawing 31. Professor FRENCH, Mr. ROGERS, Mr. MEIKLEJOHN, Mr. BOTT.

33. PROJECTION DRAWING. Three credit hours. Second year, first term.

Lectures.	Practise.	Course in
M., at 10	*Tu., Th.,* 9 *to* 11	Architecture.
W., at 11	*M., F.,* 10 *to* 12	Ceramics.
W., at 11	*M., F.,* 10 *to* 12	Chemical Engineering.
M., at 10	*Tu., Th.,* 9 *to* 11	Civil Engineering.
Tu., at 11	*M., F.,* 10 *to* 12	Electrical Engineering.
W., at 11	*M., F.,* 10 *to* 12	Industrial Arts.
M., at 10	*M., F.,* 10 *to* 12	Manual Training.
W., at 11	*M., F.,* 10 *to* 12	Mechanical Engineering.
W., at 11	*Tu., Th.,* 9 *to* 11	Mine Engineering.

Prerequisite, Drawing 2 or 32. Professor FRENCH, Mr. ROGERS, Mr. MEIKLEJOHN, Mr. BOTT.

Lectures and practise. Orthographic, isometric, and oblique projections, and elementary working drawings.

34. DESCRIPTIVE GEOMETRY. Three credit hours. Lectures and practise. Second year, second term.

Lectures	Practise	Course in
M., W., at 11	*F.,* 10 *to* 12	Ceramics.
M., W., at 11	*F.,* 10 *to* 12	Chemical Engineering.
Tu., Th., at 11	*F.,* 10 *to* 12	Electrical Engineering.
M., W., at 11	*F.,* 10 *to* 12	Industrial Arts.
M., W., at 8	*F.,* 10 *to* 12	Manual Training.
M., W., at 11	*F.,* 10 *to* 12	Mechanical Engineering.
M., W., at 11	*Tu.,* 9 *to* 11	Mine Engineering.
M., W., at 11	*Th.,* 9 *to* 11	Short Industrial Arts.

Prerequisite, Drawing 33 or 38. Professor FRENCH, Mr. ROGERS, Mr. MEIKLEJOHN, Mr. BOTT.

35. SHADES, SHADOWS, AND PERSPECTIVE. Three credit hours. Second year, third term.

Lectures	Practise	Course in
M., at 10	*Tu., Th.,* 9 *to* 11	Civil Engineering.
Tu., at 11	*M., F.,* 10 *to* 12	Electrical Engineering.
W., at 11	*M., F.,* 10 *to* 12	Industrial Arts.
M., at 8	*M., F.,* 10 *to* 12	Manual Training.
W., at 11	*M., F.,* 10 *to* 12	Mechanical Engineering.
Tu., at 11	*Tu., Th.,* 9 *to* 11	Mine Engineering.
M., at 10	*Tu., Th.,* 9 *to* 11	Short Industrial Arts.

Prerequisite, Drawing 34 or 36. Professor FRENCH, Mr. ROGERS, Mr. MEIKLEJOHN, Mr. BOTT.

36. DESCRIPTIVE GEOMETRY. Five credit hours. Architecture and Civil Engineering, second year, second term, *M., W., F., at* 8; *Tu., Th.,* 9 *to* 11, *or M., W., F., at* 11; *Tu., Th.,* 9 *to* 11. Prerequisite, Drawing 33 or 38. Professor FRENCH, Mr. ROGERS, Mr. MEIKLEJOHN, Mr. BOTT.

38. PROJECTION DRAWING. Three credit hours. Short Clayworking and Industrial Arts, first year; Short Mining, second year, second term, *Th.,* 1 *to* 4; *F.,* 1 *to* 3. Prerequisite, Drawing 2 or 32. Mr. MEIKLEJOHN.

Orthographic, isometric, and oblique projections and intersections.

39. DRAFTING AND BLUE-PRINTING. Three credit hours. Short Clay-working and Industrial Arts, first year; Short Mining and Ceramics, second year, third term, *Th., F.,* 1 *to* 4. Prerequisite, Drawing 33 or 38. Mr. ROGERS, Mr. MEIKLEJOHN.

40. CLAY MODELING. Two credit hours. Architecture, third year, second term, *Th., F.,* 1 *to* 3. Prerequisite, Drawing 26. Assistant Professor LEWIS.

Modeling in clay, oramental forms from plaster casts, photographs, and nature.

41. CLAY MODELING. Two credit hours. Architecture, third year, third term, *Th., F.,* 1 *to* 3. Prerequisite, Drawing 40. Assistant Professor LEWIS.

Modeling in clay and wax from photographs, nature, and original designs. Casts made in plaster and gelatine molds.

42. CHARCOAL DRAWING FROM ARCHITECTURAL ORNAMENT. Two credit hours. Architecture, second year, first term, *M., Tu.,* 1 *to* 3. Prerequisite, Drawing 26. Mr. TIDBALL.

43. CHARCOAL DRAWING FROM THE ANTIQUE. Two credit hours. Architecture, fourth year, first term, *M., F.,* 10 *to* 12. Prerequisite, Drawing 19. Mr. TIDBALL.

ENGLISH

(Office, University Hall, Room 116.)

PROFESSOR DENNEY, ASSISTANT PROFESSORS GRAVES, MCKNIGHT, DUNCAN, MR. MCKINNEY, MR. PARKER.

1. PARAGRAPH WRITING AND ANALYSIS OF PROSE. Two credit hours. All four-year courses, first year, first, second, and third terms, *Tu., Th., at* 9, 10, *or* 11, *or M., F.,* 10 *or* 11; *W., F., at* 3.

Writing of short themes, outlining and composition of essays and speeches and the study of illustrative texts for structure and form.

3. BRIEF-MAKING AND WRITTEN ARGUMENTATION. Two credit hours. Manual Training and Electrical and Mechanical Engineering, second year; Architecture, Ceramics, Industrial Arts, and Chemical, Civil, and Mine Engineering, third year, first, second, and third terms, *M., F., at* 10, *or Tu., Th.,* 10 *or* 11, *or W., F., at* 1. Prerequisite, English 1.

Principles of logical analysis, evidence and argumentation, writing briefs of noted speeches, preparation of original briefs with written argumentation.

FRENCH

(See Romance Languages and Literatures.)

GEOLOGY

(Office, Orton Hall, Room 1.)

PROFESSOR PROSSER, PROFESSOR BOWNOCKER, ASSISTANT PROFESSOR HUBBARD

By an act of the Legislature, the University has been put in possession of all the collections made by the geological survey, and these have been supplemented by valuable additions of fossils and minerals from various sources. The State collection embraces a very complete representation of every geological formation shown in Ohio. Exceptionally good opportunities exist for work in the lithological, stratigraphical, and physiographical laboratories.

Orton Hall is designed for the permanent accommodation of these large geological collections and for work and instruction in the department of Geology. The building is built of brick and faced with sandstone. Some of the material was contributed by various quarries of the State of Ohio, and almost all of the finer varieties of Ohio building stone are represented in the columns, walls, and ceiling panels of the vestibule.

1. PHYSIOGRAPHY. Five credit hours. Thursday afternoon will be devoted to laboratory or field work. Short Mining, first year; Short Industrial Arts, second year, third term, *M., Tu., W., Th., at* 11. Assistant Professor HUBBARD.

The topographic features of the earth's surface and the agencies producing these. The atmosphere, climate, etc. Oceans, rivers, and lakes. Recitations, lectures, map work.

2. GENERAL GEOLOGY. Five credit hours. Architecture, Ceramics, Civil, and Mine Engineering, fourth year, first term. Lectures and recitations, *M., Tu., W., F., at* 11; laboratory, *Th.;* field work first half of term, *F.* afternoon or *S.* forenoon, when the *F.* lecture will be omitted. Professor PROSSER, Assistant Professor HUBBARD.

Structural, dynamical, and historical geology. The lectures are illustrated by maps, specimens, and lantern views. The common rock-forming minerals and rocks are studied in the laboratory; while in the field specimens are collected, sections measured, formations identified, and the student given an idea of the method of work pursued by a field geologist.

4. ELEMENTARY GEOLOGY. Five credit hours. Short Mining, second year, second term, *M., Tu., W., Th., F., at* 9. Assistant Professor HUBBARD.

Lithological, dynamical, structural, and historical geology. Recitations, lectures, laboratory work.

6. ECONOMIC GEOLOGY. Three credit hours. Ceramics, Civil, and Mine Engineering, fourth year, second term, *M., W., F., at* 11. Prerequisite, Geology 2. Professor BOWNOCKER.

The nature of ores, their classification, and origin. The metals of the United States, their distribution, abundance, modes of occurrence, and origin. The non-metals, coal, oil, gas, clay, lime, cement, building stone, etc. In the discussion of the non-metals emphasis will be laid on the products of Ohio.

7. PETROGRAPHY. Two credit hours. Ceramics and Mine Engineering, fourth year, second term, *Tu.*, 10 *to* 12; *F., at* 10. Concurrent, Geology 6. Professor BOWNOCKER.

The igneous, sedimentary, and metamorphic rocks—their origin and classification.

GERMANIC LANGUAGES AND LITERATURES

(Office, University Hall, Room 317.)

PROFESSOR RHOADES, ASSOCIATE PROFESSOR VILES, ASSISTANT PROFESSOR EISENLOHR

1. ELEMENTARY GERMAN. Four credit hours. First, second, and third terms, *M., Tu., Th., F., at* 10 *or* 11, *or Tu., W., Th., F., at* 9, 2, *or* 3.

German 1 may be taken by students who enter with no entrance credits in German.

2. SCIENCE READING. Four credit hours. Third term, *M., Tu., W., Thu., at* 9 *or* 2. Prerequisite, German 4.

German 2 must be taken by all Engineering students who take German 4 the first and second terms.

4. INTERMEDIATE GERMAN. Four credit hours. First and second terms, *M., Tu., Th., F., at* 10 *or* 11; *Tu., W., Th., F., at* 8, 9, 2, *or* 3. Prerequisite, German 1, or two units entrance German.

Review of Grammar. Reading of descriptive and narrative prose, with prose composition. German 4 should be taken by Engineering students who enter with two units entrance German.

INDUSTRIAL ARTS

(Office, Hayes Hall, Room 2.)

PROFESSOR SANBORN, ASSISTANT PROFESSOR KNIGHT, MR. CROWE, MR. CASE, MR. BEEM, AND MR. DENMAN

The shops in Hayes Hall afford excellent facilities for instruction in both the practical details and the underlying principles of carpentry, pattern-making, forging, molding, founding, and machine work.

The carpenter and pattern shop contains twenty-five benches with complete sets of carpenter tools, twenty-three turning lathes, eight-foot pattern-maker's lathe with compound rest, pony planer, buzz planer, circular saw, scroll saw, 36-inch band saw, a band-saw filing and setting machine, trimmer, and power grindstone.

The forge shop has twenty stationary forges, with anvils and tools, a special combination gas-furnace, heating furnace, four blacksmith's vises, foot-power hammer, blacksmith's drill and a punch, shear and bar cutter. The blast and exhaust fans are driven by an electric motor.

The foundry has a 24-inch Colliau cupola; two brass furnaces, core oven, space for floor molding 30 feet by 40 feet, and the necessary molding tools, flasks, crucibles, ladles, tongs, etc.

The machine shop is driven by an electric motor from above, and is equipped with twenty-eight benches for vise work with complete sets of tools, eight speed lathes, sixteen engine lathes, Fox monitor turret lathe, two planers, two shapers, two milling machines, two upright drills, sensitive drill, arbor presses, grinding machine, tool grinders, emery wheels, etc. The tool-room contains full sets of drills, taps, dies, milling cutters, standard plugs, gauges, threads, micrometers, and a great variety of special tools.

INDUSTRIAL ARTS

1. Tools and Machines. Three credit hours. Industrial Arts and Manual Training, third year; Short Industrial Arts, second year, first, second, and third terms, *M., W., F., at* 8. Prerequisite, Mathematics 14 or 32. Concurrent, Physics 1. Professor Sanborn.

Principles underlying the construction and operation of machine tools, and materials used in construction.

2. Designing. Three credit hours. Industrial Arts and Manual Training, third year; Short Industrial Arts, second year, second and third terms, *F.,* 1 *to* 4; *S.,* 8 *to* 11. Professor Sanborn.

Problems in design, to accompany 1.

3. Shop Equipment, Appliances, and Management. Three credit hours. Industrial Arts, fourth year, first, second, and third terms, *M., W., F., at* 11. Prerequisite, Industrial Arts 1. Concurrent, Industrial Arts 4. Professor Sanborn.

Strength and durability of the materials used in construction; shop and factory buildings and their construction; power, power transmission and prime movers; methods of compensation, and shop accounts and management.

4. ADVANCED DESIGNING. Three credit hours. Industrial Arts, fourth year, first and second terms, *M., Tu.,* 1 *to* 4; Third term, *W., Th.,* 1 *to* 4. Prerequisite, Drawing 5. Concurrent, Industrial Arts 3. Professor SANBORN.

Graphical problems in construction. Design of buildings and the arrangement of machinery, line-shafting, etc., for manufacturing plants.

5. WORKSHOP APPLIANCES. Three credit hours. Mechanical Engineering, fourth year, third term, *M., W., F., at* 8. Prerequisite, Civil Engineering 19. Professor SANBORN.

Lectures and problems on the construction of shop buildings and the arrangement of machinery; special shop appliances.

8. MACHINE DRAWING. Three credit hours. Short Industrial Arts, second year, first term, *Th., F.,* 1 *to* 4. Prerequisite, Drawing 39. Professor SANBORN.

Working sketches of mechanisms and machines from measurement; detail and assembly drawings of same.

9. MACHINE DESIGN. Two credit hours. Electrical Engineering, fourth year, second term, *M., W.,* 1 *to* 3. Prerequisite, Mechanics 2 and Drawing 5. Professor SANBORN.

Practical application of the principles of machine design.

SHOPWORK

NOTE.—For time requirements, credit given, and all similar information concerning shopwork courses, see table page 73.

3. FOUNDRY WORK. Mr. BEEM.

Exercises and practise in tempering sand and preparing molds of machine parts in the sand, core-making, melting iron and brass, and pouring castings.

4. CHIPPING AND FILING. Assistant Professor KNIGHT, Mr. CASE.

Exercises and practise in vise work, including chipping in cast and wrought iron, surface filing, squaring, fitting, finishing, and the scraping of surface plates.

7. CARPENTRY AND PATTERN MAKING. Mr. BEEM, Mr. DENMAN.

Exercises and practise in carpentry, wood-turning, and pattern-making, including sawing, planing, mortising, framing, and other work, involving the use of the ordinary carpenter tools; center and chuck turning, the making of finished patterns; and enough elementary molding to illustrate draft, parting, cores, etc.

8. CABINET WORK. Prerequisite, Shop 7. Mr. BEEM, Mr. DENMAN.

Exercises and practise in cabinet making, including paneling, mitre and dovetail joints, etc.; use of power tools.

9. ADVANCED PATTERN MAKING. Continuation of pattern work of Shopwork 7. Mr. BEEM, Mr. DENMAN.

11. FORGING. Mr. CROWE.

The use and care of forge, fire, and tools; practise in iron and steel forging, including such operations as cutting, bending, drawing, upsetting, shaping and welding iron; the making, hardening and tempering of steel punches, chisel and lathe tools.

12. ADVANCED FORGING. Prerequisite, Shop 11. Mr. CROWE.

Various forms of welds in iron and steel; the use of scrolling irons and of forms for duplicating work; annealing; tool-making; case-hardening; tempering drills, dies, and cutters; spring-making; ornamental iron work; visits to shops.

13. MACHINE WORK. Assistant Professor KNIGHT, Mr. CASE.

Exercises and practise in hand-turning in iron and brass on speed lathes; in straight and taper turning, boring, fitting, chucking, and thread-cutting on engine lathes.

14. MACHINE WORK. Prerequisite, Shop 13. Assistant Professor KNIGHT, Mr. CASE.

Exercises and practise on the lathe, planer, shaper, drill press, and milling machine, with use of small tools as drills, taps, dies, reamers, counter-borers, etc.; construction of parts of actual machines.

15. ADVANCED MACHINE WORK. Prerequisite, Shop 14. Assistant Professor KNIGHT.

Exercises and practise on turret lathe, universal, surface, and tool grinding machines; in gear-cutting, etc.

16. ADVANCED MACHINE WORK. Prerequisite, Shop 15. Assistant Professor KNIGHT.

The construction and use of jigs and templates; the accurate laying out of work; the duplication of parts; the production of work rapidly and economically, etc.

17. ADVANCED MACHINE WORK. Prerequisite, Industrial Arts 3 and Shop 16. Assistant Professor KNIGHT.

The making and use of special tools and fixtures, standard plugs and collars, standard caliper and limit gauges; error limits in modern machine construction; methods of testing the accuracy of machine tools, etc.

SUMMER TERM. The Summer Term in Shopwork will begin on Monday morning preceding Commencement Day and continue for four weeks. The courses open to students are Shopwork 4, 7, 11, 13, 14, and 15, three credit hours in each. Each course requires three hours a day for six days a week.

Students electing the Ceramics or the Electrical or Mechanical Engineering Course are required to take two of the three courses, Shopwork 4, 7, and 11 at the close of their first year.

Students electing the Chemical Engineering Course are required to take Shopwork courses 7 and 11 at the close of their first or second year.

Students electing the Industrial Arts Course or the Short Course in Clay-working are required to take Shopwork 7 and 11 at the close of their first year.

The courses are open as elective to students who desire to lighten their work of the regular terms, to make up back work or to take extra work.

SHOPWORK REQUIRED

Number	Credit hours	Subject	Year	Term	Hours	Courses in
3	2	Founding	2	1	M. 3, Tu. 1-4; W. 3, Th. 1-4; or S. 8-12	Ind. Arts; Mech. Eng.
3	2	Founding	2	1	M. 1-4; Tu. 1-4	Short Ind. Arts.
3	3	Founding	2	1	M. 3, Tu. 1-4	Manual Train.
3	2	Founding	..	2	Th. 3, F. 1-4	
4	3	Chipping and Filing	2	1	W. 1-4; S. 9-12	Short Ind. Arts.
4	3	Chipping and Filing	..	..	(See Courses)	El. Eng.; Mech. Eng.
4	3	Chipping and Filing	2	3	M. Tu. 1-4	Ind. Arts.
4	3	Chipping and Filing	3	1	M. Tu. 9-12	Manual Train.
7	2	Woodworking	2	1	M. F. 10-12	Mining Eng.
7	3	Woodworking	1	1	M. Tu. 1-4	Short Ind. Arts.
7	3	Woodworking	2	1	Th. F. 1-4	Manual Train.
7	3	Woodworking	..	..	(See Courses)	Chem., El. & Mech. Eng. & Ind. Arts.
8	3	Cabinet Work	2	3	M. Tu. 1-4	Manual Train.
9	3	Adv. Pattern Work	2	1	Tu. Th. 9-12; or Th. F. 1-4	Mech. Eng.
9	3	Adv. Pattern Work	1	2	M. Tu. 1-4	Short Ind. Arts.
9	3	Adv. Pattern Work	2	2	M. Tu. 1-4	Ind. Arts; Man. Tr.
9	3	Adv. Pattern Work	..	..	(See Courses)	Mech. Eng.
11	3	Forging	..	..	(See Courses)	Chem., El. & Mech. E. & Ind. Arts.
11	2	Forging	2	2	Th. F. 10-12	Mining Eng.
11	3	Forging	2	2	Th. F. 1-4	Manual Train.
11	3	Forging	1	3	M. Tu. 1-4	Short Ind. Arts.
11	3	Forging	2	3	M. Tu. 1-4	Short Mining.
12	3	Adv. Forging	2	3	Th. F. 1-4	Manual Train.
13	3	Machine Work	2	2	M. Tu. 1-4; or W. Th. 1-4; or F. 1-4, S. 8-11	Elec. Eng.
13	3	Machine Work	3	2	M. Tu. 9-12	Manual Train.
13	3	Machine Work	3	..	M. Tu. 1-4	Ind. Arts.
13	3	Machine Work	2	2	W. Th. 1-4	Short Ind. Arts.
13	3	Machine Work	2	3	M. Tu. 1-4; or F. 1-4, S. 8-11	Mech. Eng.
14	3	Adv. Machine Work	3	1	M. Tu. W. 8-10; or Th. F. S. 8-10	Elec. Eng.
14	3	Adv. Machine Work	3	1	M. Tu. Th. 10-12; or M. Tu. 1-4	Mech. Eng.
14	3	Adv. Machine Work	2	3	W. Th. 1-4	Short Ind. Arts.
14	3	Adv. Machine Work	3	3	M. F. 9-12	Manual Train.
14	3	Adv. Machine Work	3	2	M. Tu 1-4	Ind. Arts.
15	3	Adv. Machine Work	4	1	F. 1-4; S. 8-11	Manual Train.
15	4	Adv. Machine Work	3	2	M. Tu. Th. F. 10-12; or F. 1-5, S. 8-12	Mech. Eng.
15	3	Adv. Machine Work	3	3		Ind. Arts.
16	3	Adv. Machine Work	4	1		Ind. Arts.
16	3	Adv. Machine Work	4	2	M. W. F. 8-10	Ind. Arts; Man. Tr.
17	3	Adv. Machine Work	4	3	M. Tu. 1-4	Ind. Arts.

MATHEMATICS

(Office, University Hall, Room 314.)

PROFESSOR BOHANNAN, ASSOCIATE PROFESSOR MCCOARD, ASSOCIATE PROFESSOR SWARTZEL, ASSOCIATE PROFESSOR KUHN, ASSISTANT PROFESSOR ARNOLD, ASSISTANT PROFESSOR RASOR, ASSISTANT PROFESSOR PRESTON, MISS BAREIS, MR. CHAMBERS

2. ELEMENTARY ALGEBRA. Five credit hours. Text-book: Wentworth's Algebra. Short Clay-working, Industrial Arts, and Mining, first year, first, second, and third terms, *M., Tu., W., Th., F., at* 9.

3. PLANE GEOMETRY. Five credit hours. Text-book: Venable's Geometry. Short Clay-working, Industrial Arts, and Mining, first year, first term, *M., Tu., W., Th., F., at* 11.

11. DIFFERENTIAL EQUATIONS. One credit hour. Text-book: Boyd's Differential Equations. Mechanical Engineering, third year, first term, *F., at* 10. Prerequisite, Mathematics 43.

13. SOLID GEOMETRY. Five credit hours. Text-book: Venable's Geometry. Short Clay-working, Industrial Arts, and Mining, first year, second term, *M., Tu., W., Th., F., at* 11. Prerequisite, Mathematics 3.

14. PLANE TRIGONOMETRY. Five credit hours. Text-book: Bohannan's Trigonometry. Short Clay-working, Industrial Arts, and Mining, first year, third term, *M., Tu., W., Th., F., at* 8.

31. COLLEGE ALGEBRA. Five credit hours. Text-book: Hawkes' College Algebra. All four-year courses, first year, first term, *M., Tu., W., Th., F., at* 8, 9, 11, 2, *or* 3.

This course is repeated in the second term for the benefit of students who fail in it in the first term.

32. TRIGONOMETRY. Five credit hours. Text-book: Bohannan's Trigonometry. All four-year courses, first year, second term, *M., Tu., W., Th., F., at* 8, 9, 11, 2, *or* 3.

This course is repeated in the third term for the benefit of students who fail in it in the second term.

33. ANALYTICAL GEOMETRY. Five credit hours. Text-book: Ashton's Analytical Geometry. All four-year courses, first year, third term, *M., Tu., W., Th., F., at* 8, 9, 11, 2, *or* 3. Prerequisite, Mathematics 32.

This course is repeated in the Summer Term.

41. CALCULUS. Five credit hours. Text-book: Osborne's Calculus. Second year, first term. Architecture, Ceramics, Chemical,

Electrical, and Mine Engineering, *M., Tu., W., Th., F., at* 8; Civil Engineering, *M., Tu., W., Th., F. at* 8 *or* 11; Mechanical Engineering, *at* 8 *or* 9. Prerequisite, Mathematics 33.

42. CALCULUS. Five credit hours. Text-book: Edwards' Differential Calculus for Beginners. Second year, second term. For hours and courses see Course 41. Prerequisite, Mathematics 41.

43. CALCULUS. Five credit hours. Text-book: Murray's Integral Calculus. Second year, third term. For hours and courses see Course 41. Prerequisite, Mathematics 41.

74. DIFFERENTIAL EQUATIONS. Three credit hours. Second term. Elective. Prerequisite, Mathematics 43. Text-book: Boyd's Differential Equations.

25. HIGHER MATHEMATICS. Elective. See Bulletin of the College of Arts, Philosophy, and Science for special courses.

MECHANICAL ENGINEERING

(Office, Engineering Laboratory, Room 201.)

PROFESSOR MAGRUDER, PROFESSOR HITCHCOCK, ASSISTANT PROFESSOR JUDD, ASSISTANT PROFESSOR RIGDON, MR. FISHER

The lectures and recitations of this department are at present held in the Mechanical Engineering Laboratory of the new Engineering Building. The Engineering Museum contains samples of engineering supplies and materials and a collection of models of mechanism, valve gears, and parts of machines.

The new laboratories are arranged to carry on experiments and investigations along the following general lines: Strength and other physical properties of materials in compression, tension, torsion, cross breaking and shearing; gas, hot air, and steam engines, under varied conditions of running; hydraulics, including pumps and water-wheels; pneumatics, including air-brakes, compressors, fans, and ventilating systems; power transmission, including belts, pulleys, and oils; boiler testing; calibration of instruments.

Some of the principal machines at present in use for the above work are Olsen and Riehle testing machines; four gas and oil engines; Ericsson and Rider hot-air engines, three 35-horse power horizontal and one vertical, simple and compound steam engines with condensers; simple, compound, triplex, centrifugal and rotary pumps, pulsometer, turbine and impulse wheels, cisterns, tanks, weirs, meters, flume, hydraulic engines and rams; set of Westinghouse air-brake apparatus, air-compressors, compressed air engine, blower and ventilating fans, two complete heating and ventilating systems arranged for experimental study, belt machines, lubricant and oil testers; Robinson's experiment steam boiler, with natural, forced, and induced drafts; air-preheater, and economizer, locomotive boiler, internally-fired stationary boiler, calorimeters, injectors, gauges. The University power and refrigerating plants and the mechanical equipments in the different buildings upon the grounds add to the facilities for engineering tests.

Besides the above, opportunities frequently arise for the students to take part in tests made of machinery, engines, and boilers in the city and vicinity.

3. MECHANISM. Five credit hours. Mechanical Engineering, third year, second term, *M., Tu., W., Th., F., at* 8. Prerequisite, Drawing 33 and Physics 2. Two credit hours. Mechanical Engineering, third year, third term. Time to be arranged. Professor HITCHCOCK.

Lectures and recitations on the principles or mechanism and mechanical movements.

12. EXPERIMENTAL ENGINEERING LABORATORY. Two credit hours. Mechanical Engineering, third year, first term, *W.,* 1 *to* 5, *or S.,* 8 *to* 12. Industrial Arts, fourth year, first term, *Th.,* 1 *to* 5. Prerequisite, Drawing 33. Concurrent, Mechanics 1, or Industrial Arts 3. Assistant Professor RIGDON, Mr. MARTIN.

Calibration of pressure gauges and indicator springs; steam engine indicator practise and oil testing.

14. Continuation of 27. Four credit hours. Mechanical Engineering, fourth year, second term, *M., W.,* 1 *to* 5. Concurrent, Mechanical Engineering 34. Professor HITCHCOCK, Assistant Professor RIGDON.

Testing of steam boilers and injectors.

15. Continuation of 14. Three credit hours. Mechanical Engineering, fourth year, third term, *M., Tu.,* 9 *to* 12. Professor HITCHCOCK, Assistant Professor RIGDON.

Testing of steam, centrifugal, and power pumps, pulsometer, hydraulic rams, impulse and turbine water-wheels and air compressors.

17. EXPERIMENTAL ENGINEERING. Three credit hours. Civil Engineering, fourth year, second term, *Th., at* 11; *F.,* 1 *to* 5. Prerequisite, Drawing 33, and Mechanics 3. Professor HITCHCOCK, Assistant Professors JUDD and RIGDON.

Practise in the testing of materials of construction, calibration of orifices and weirs, study of the flow of liquids and gases, accompanied by lectures and recitations on steam engines, boilers, and power transmission.

18. MACHINE DESIGN. Five credit hours. Chemical and Mechanical Engineering, fourth year, first and second terms, *M., Tu., W., Th., F., at* 9. Prerequisite, Drawing 5 or 33; Mechanics 3; Metallurgy 4. Professor MAGRUDER.

19. MACHINE DESIGN. Five credit hours. Chemical and Mechanical Engineering, fourth year, third term, *M.,* 1 *to* 5; *Tu., W.,* 1 *to* 4. Prerequisite, Mechanical Engineering 18. Professor MAGRUDER.

Practical applications of the principles of machine designs.

21. THESIS WORK. Five credit hours. Mechanical Engineering, fourth year, third term. Professors MAGRUDER and HITCHCOCK.

23. MATERIALS OF CONSTRUCTION. Four credit hours. Architecture, fourth year, first term, *Tu., Th., at* 8; *W.,* 1 *to* 5. Prerequisite, Mechanics 1. Professor HITCHCOCK.

Lectures and recitations on the materials used in architectural and building construction, and laboratory exercises on their properties.

24. EXPERIMENTAL ENGINEERING LABORATORY. Three credit hours. First and second terms. Elective to third and fourth year engineers. (Not given in 1908-1909.)

Arranged to meet the needs of those desiring to elect advanced laboratory work.

25. Continuation of 17. Five credit hours. Civil Engineering, fourth year, third term, *Th., at* 11; *M., Tu.,* 1 *to* 5. Professor HITCHCOCK, Assistant Professors JUDD and RIGDON.

Tests of steam, power, rotary, and centrifugal pumps; water motor and turbine wheel.

27. Continuation of 12. Five credit hours. Mechanical Engineering, fourth year, first term, *M.*, 1 *to* 5; *F.*, 10 *to* 5. Concurrent, Mechanical Engineering 33. Professor HITCHCOCK, Assistant Professors JUDD and RIGDON.

Testing materials of construction, tests of steam and hot-air engines, transmission and absorption, dynamometer trials, and testing of belts.

28. EXPERIMENTAL ENGINEERING LABORATORY. Two credit hours. Electrical Engineering, third year, third term, *Th., or F.*, 1 *to* 5. Manual Training, fourth year, third term, *F.*, 1 *to* 5. Concurrent, Mechanical Engineering 32. Assistant Professors JUDD and RIGDON.

Testing of pressure gauges and indicator springs, steam engine indicator practise, and testing of lubricating oils.

29. Continuation of 28. Three credit hours. Electrical Engineering, fourth year, first term, *Tu., or Th.*, 10 *to* 12, 1 *to* 5. Two credit hours. Industrial Arts, fourth year, second term, *W.*, 1 *to* 5. Assistant Professors JUDD and RIGDON.

Testing materials of construction, transmission and absorption, dynamometer tests, steam engine trials.

30. Continuation of 29. Two credit hours. Electrical Engineering, fourth year, second term, *Tu., or Th.*, 1 *to* 5. Industrial Arts, fourth year, third term, *F.*, 1 *to* 5. Assistant Professors JUDD and RIGDON.

Steam engine and boiler trials, steam and power pump tests, hydraulic experimentation, gas and oil engine trials.

31. HYDRAULIC MACHINERY. Three credit hours. Mechanical Engineering, fourth year, third term, *Tu., Th., at* 8; *W., at* 9. Prerequisite, Mechanics 3 and Mechanical Engineering 33. Professor HITCHCOCK.

Recitations and lectures on pumping machinery.

32. MECHANICAL ENGINEERING OF POWER PLANTS. Five credit hours. Chemical and Electrical Engineering and Industrial Arts, third year, third term, *M., Tu., W., Th., F., at* 8 *or* 9. Mechanical Engineering, third year, third term, *M., Tu., W., Th., F., at* 8, *or* 9. Manual Training, fourth year, third term, *M., Tu., W., Th., F., at* 8. Prerequisite, Mechanical Engineering 3, or Industrial Arts 1; Drawing 5 or 22, and Physics 2. Professor MAGRUDER.

A descriptive study of steam and gas engines, boilers, pumps, injectors, and other machinery used in plants generating power.

33. STEAM ENGINES AND BOILERS. Five credit hours. Electrical and Mechanical Engineering, fourth year, first term, *M., Tu.,*

W., Th., F., at 8. Prerequisite, Mechanics 3 and Mechanical Engineering 32. Professor MAGRUDER.

A detail study of steam-using and steam-generating machinery.

34. THERMODYNAMICS. Five credit hours. Mechanical Engineering, fourth year, second term, *M., Tu., W., Th., F., at* 8. Prerequisite, Mechanical Engineering 33. Professor MAGRUDER.

The transmutations of heat and mechanical energies in steam, gas, and air engines, in air and ammonia compressors and in refrigeration machines, together with a study of the tests of ideal and actual engines and of their indicator diagrams; the flow of gases through pipes and orifices.

35. EXPERIMENTAL ENGINEERING LABORATORY. Five credit hours. Option, Chemical Engineering, fourth year, second term, *F., at* 11; *Th., F.,* 1 *to* 5. Prerequisite, Mechanics 3 and Mechanical Engineering 32. Assistant Professors JUDD and RIGDON.

Testing of pressure gauges and indicator springs followed by steam engine indicator practise with engine and pump economy tests; testing of lubricating oils; ventilating fan trials and boiler fuel tests; accompanied by lectures relating to apparatus used in the experimentations.

36. EXPERIMENTAL ENGINEERING LABORATORY. Five credit hours. Ceramics and Mine Engineering, fourth year, third term, *Tu., Th.,* 10 *to* 11; *W., Th.,* 1 *to* 4. Prerequisite, Mechanics 3 and Metallurgy 4. Professor HITCHCOCK, Assistant Professors JUDD and RIGDON.

Lectures and recitations on power transmission, steam engines and boilers. Laboratory; testing pressure gauges, indicator springs, etc.; valve setting; testing of steam engines, steam, power, and centrifugal pumps; boiler and fuel trials.

37. MECHANISM. Four credit hours. Electrical Engineering, third year, second term, *M., Tu., Th., F., at* 10. Professor HITCHCOCK, Assistant Professor JUDD.

Lectures and recitations on the principles of mechanism and mechanical movements.

38. INSPECTION TRIP TO THE EAST. Given only in the even years. Mechanical Engineering, third or fourth year.

Includes Pittsburg, Buffalo, Niagara Falls, Cleveland, and possibly other places; is taken at the end of the winter term, and occupies six days. The entire expense need not exceed $30.00. A satisfactory written report upon the work of the trip is required.

39. INSPECTION TRIP TO THE WEST. Given only in the odd years. Mechanical Engineering, fourth or third year.

Includes Chicago, Milwaukee, Cincinnati, and possibly other places; is taken at the end of the winter term and occupies six days. The entire expense need not exceed $30.00. A satisfactory written report upon the work of the trip is required.

40. WRITTEN REPORT. Course of assigned reading upon processes of manufacture and power plants may be reported upon by third and fourth-year students in Mechanical Engineering as a substitute for 38 on presentation of reasons satisfactory to the head of the department.

41. Similar to 40. A substitute for 39.

42. HEATING ANL VENTILATING. Three credit hours. Architecture, fourth year, second term, *M., W., F., at* 9. Professor HITCHCOCK.

Recitations and lectures on the principles and methods of heating and ventilation, with laboratory work and investigations of the heating and ventilating plants of different buildings.

43. MECHANISM AND DESIGN. Five credit hours. Ceramic Engineering, third year, third term, *M., Tu., W., Th., F., at* 8. Assistant Professor JUDD.

Lectures and recitations on the principles of mechanism, mechanical movements, and elementary machine design.

MECHANICS

(Office, Mines Building, Room 219.)

PROFESSOR J. E. BOYD, ASSISTANT PROFESSOR CODDINGTON

1. STATICS. Five credit hours. Architecture, Ceramics, and Chemical, Civil, Electrical, Mechanical, and Mine Engineering, third year, first term, *M., Tu., W., Th., F.,* 8, 9 *or* 11. Prerequisite, Mathematics 43. Text-book: Hoskin's Theoretical Mechanics.

2. STRENGTH OF MATERIALS, KINETICS. Five credit hours. Architecture, Ceramics, and Chemical, Civil, Electrical, Mechanical, and Mine Engineering, third year, second term, *M., Tu., W., Th., F.,* 8, 9, 11 *or* 2. Prerequisite, Mechanics 1. Text-book: Merriman's Mechanics of Materials, Cambria Steel.

3. KINETICS AND HYDRAULICS. Five credit hours. Chemical, Civil, Electrical, Mechanical, and Mine Engineering, third year, third term, *M., Tu., W., Th., F.,* 8, 9 *or* 11. Prerequisite, Mechanics 2. Text-books: Hoskin's Theoretical Mechanics, Goodman's Mechanics of Engineering.

METALLURGY AND MINERALOGY

(Office, School of Mines Building.)

PROFESSOR N. W. LORD, ASSOCIATE PROFESSOR SOMERMEIER,
MR. MCQUIGG

The equipment of the Department of Metallurgy is unusually complete. It occupies about 14,000 square feet of floor space in the new School of Mines building, which has just been built and equipped at a cost of $110,000. It includes a chemical laboratory with accommodations for forty students, an assay laboratory in a fire-proof wing, laboratories for general and determinative mineralogy, technical gas analysis, coal sampling and testing, including determinations of heating value, microscopic metallographic work, crushing and sampling plant for use in experimental tests on ores and minerals, together with lecture rooms, museum, and offices.

2. Mineralogy. Three credit hours. Chemical and Mine Engineering, second year, third term, *M., W., F., at* 11. Prerequisite, Chemistry 12. Lectures arranged so as to be preparatory to Determinative Mineralogy. Professor Lord.

3. Determinative Mineralogy. Five credit hours. Mine Engineering, third year, third term, *M., Tu.,* 1 *to* 5. Prerequisite, Metallurgy 2. Professor Lord, Associate Professor Somermeier.

Lecture and laboratory work in practical determination of minerals by physical and chemical tests. Each student is furnished with a set of apparatus and works under an instructor's inspection. Brush's Determinative Mineralogy is used as a manual.

4. Metallurgy. Five credit hours. Mine Engineering, third year, first and second terms. Option, Chemical Engineering, fourth year, first and second terms. Industrial Arts and Mechanical Engineering, third year, first term and first two-fifths of second term. Ceramics, fourth year, first term, *M., Tu., W., Th., F., at* 9. Prerequisite, Chemistry 12, and Physics 2. Professor Lord.

A course of lectures upon fuel and its uses, iron and steel, copper, lead, gold, and silver, their properties, tests, ores, and details of the methods of reduction. The lectures are supplemented by a careful study of references to standard works and journals.

5. Metallurgical Laboratory. Five credit hours. Mine Engineering, second year, first, second, and third terms. Chemical

Engineering, third year, first term, *W., Th., F.,* 1 *to* 4. Prerequisite, Chemistry 12. Associate Professor SOMERMEIR.

Lectures and laboratory work. Laboratory practise in the analysis of iron and steel, fuel and slags, and the assay of lead, copper, and zinc ores by wet methods, using approved methods as practised in technical laboratories and metallurgical works.

6. ASSAYING. Five credit hours. Mine Engineering and Chemical Engineering, third year, second term, *M., Tu., at* 11; 1 *to* 5. Prerequiste, one term of Metallurgy 5. Professor LORD, Associate Professor SOMERMEIER.

Lectures and laboratory work. Practical work in the assaying of gold, silver, and lead ores, by furnace methods.

7. METALLURGICAL CONSTRUCTION. Three credit hours. Mine Engineering, fourth year, second term, *M., Tu., Th., at* 10. Prerequisite, Drawing 5, Mechanics 3, Metallurgy 4 and 8. Professor LORD, Professor RAY.

Lectures and drawing room practise in the designing of furnaces and other metallurgical machinery, including detail drawings and estimates.

8. ORE DRESSING AND COAL WASHING. Two credit hours. Mine Engineering, fourth year, first term, *Tu., F., at* 10. Prerequisite, Metallurgy 4. Professor LORD.

Methods of concentrating and enriching ores and fuels by mechanical means. Lectures with reference to standard books and various papers in technical journals.

9. MINERAL CHEMISTRY. Five credit hours. Short Mining, second year, third term, *M., Tu., W., Th., F., at* 8. Prerequisite, Chemistry 3. Professor LORD.

Lectures upon fire-damp, mine explosions, explosives, boiler waters, mine gases, iron ores; iron and steel, their properties and modes of manufacture; coal and coke.

MILITARY SCIENCE AND TACTICS

(Office, Armory.)

CAPTAIN GEORGE L. CONVERSE, U. S., RETIRED

The Military Department is open five days during each week of each term. Required of all students first and second year, unless excused by the Military and Gymnasium Board.

1. MILITARY DRILL. One credit hour. First and third terms. *M., Tu., W., at* 11 *or* 4.

2. MILITARY DRILL. One credit hour. Second term; Drill Regulations, *M., Tu., W., at* 11 *or* 4; Gallery Practise, *M., Tu., W., Th.,* 1 *to* 5.

MINE ENGINEERING

(Office, School of Mines Building.)

PROFESSOR RAY, MR. MINOR

This department is equipped with all of the latest improved instruments and apparatus used in mine engineering, surveying, and the study of mine ventilation. There is a collection of models of mine machinery and supplies, to which additions are being made; also a large collection of lantern views of machines, mines, and mine equipment. In the drafting room each student is personally taught the making of maps, the platting of actual surface and underground surveys, the making of drawings, tracings, and blueprints. Emphasis is laid upon proper methods of keeping notes and all records necessary to an efficient engineer's office. The students make actual surveys of coal mines, and work up their notes complete in all of the necessary details. They are also taught how to make working drawings, plans, estimates, and specifications of mining operations and equipment.

The Mine Engineering course pays special attention to underground surveying, mapping, timbering, ventilation, and other matters relating to safety and speed, system and method in extracting coal and other minerals. The coal mines of central Ohio furnish extremely valuable illustrations of the practise in these lines, and of the general arrangement of mining plants. The mining students are required to make frequent trips and to spend sufficient time at the mines in actual work and observation to become familiar with practical mine surveying and the details of mine equipment and management.

1. MINE SURVEYING. Five credit hours. Short Mining, second year, first term, *M., Tu., W., Th., F., at* 11. Prerequisite, Mathematics 14.

Lectures and field practise. This is similar to Course 4, but more elementary. The same text is used. The students have more practise in the drawing room.

2. VENTILATION AND HAULAGE. Five credit hours. Short Mining, second year, second term, *M., Tu., W., Th., F., at* 11. Prerequisite, Mine Engineering 1, and Physics 1.

Lectures illustrated by experiments and maps of mines and models when possible, tests by safety lamps and anemometers, and methods of air distribution in coal mines.

3. MINE OPERATING. Five credit hours. Short Mining, second year, third term, *M., Tu., W., Th., F., at* 11. Prerequisite, Mine Engineering 2.

A course of lectures and practical instruction in mine bookkeeping and accounts, cost of working, etc., particularly adapted to Ohio coal mining.

4. MINE SURVEYING. Five credit hours. Mine Engineering and Ceramics, third year, first term, *M., Tu., Th., F., at* 10; *M.,* 1 *to* 3. Prerequisite, Drawing 33, and Mathematics 32.

Field practise in the use of instruments for surface and underground surveys. Full notes are taken and maps and plans made in the drawing-room. Davies's Surveying by Van Amringe is used as a text-book.

5. MINE ENGINEERING. Five credit hours. Lectures. Mine Engineering, fourth year, first, second and third terms, *M., Tu., W., Th., F., at* 8. Prerequisite, Mechanics 3, and Mine Engineering 4. Concurrent, Geology 2.

Mine operating, mining machinery, ventilation, shaft-sinking, workout out deposits, etc. Constant reference is required to the standard works and to the leading technical journals, with practise in designing mine plants, drafting, and estimates.

6. PLANS AND SPECIFICATIONS. Five credit hours. Mine Engineering, fourth year, third term, *M., F., at* 10; *F.,* 1 *to* 4; *S.,* 8 *to* 11. Prerequisite, Metallurgy 7, and Mine Engineering 5.

7. SURVEYING. One credit hour. Mine Engineering, third year; Short Mining, second year; second term. Prerequisite, Mine Engineering 1 or 4.

Practical experience in surveying in some mine convenient to Columbus; the time taken in one trip not more than four consecutive days.

PHYSICS

(Office, Physics Building, First Floor.)

PROFESSOR THOMAS, ASSOCIATE PROFESSOR KESTER, ASSISTANT PROFESSOR EARHART, ASSISTANT PROFESSOR BLAKE, MR. BAILEY, MR. SHEARD, MR. KELLOGG, MR. BARNES MR. COGGINS

The department of Physics occupies the three stories and basement of the new Physics Building, a building in the design and construction of which special care has been taken to secure ample light, ventilation, and rigidity of floors and supports. The floor area of the building is thirty thousand square feet. The two wings included in the plan of the building will, when erected, add twenty-five thousand square feet of floor area. The department has a generous supply of apparatus for the experimental illustration of the lecture courses, and for elementary and advanced laboratory work. The best instrument makers of this and foreign countries are well represented in the equipment, which is especially strong in standards, and in apparatus for precise measurement.

1. ELEMENTARY PHYSICS. Recitations, experimental lectures and laboratory. Text: Millikan & Gale, "Elements of Physics." Five credit hours.Short Mining, first year, first and second terms, *M., Tu., W., F., at* 8, and one three-hour laboratory period, *Tu., W., or Th.,* 1 *to* 4. Short Clay-working and Industrial Arts, second year, first and second terms, *M., Tu., W., F., at* 8, and one laboratory period, as above. Prerequisite, Mathematics 14. Assistant Professor EARHART.

2. GENERAL PHYSICS. Three credit hours. All four-year courses, second year, first, second, and third temrs, *M., W., at* 9, *or Tu., Th., at* 11. One period experimental work, any afternoon, 2 *to* 4. Quiz, *F.,* time to be arranged. Prerequisite, Mathematics 33. Professor THOMAS.

3. PHYSICS. Two credit hours. Extension of Course 2, with practise in solution of problems. Electrical Engineering, Ceramics, Industrial Arts, and Manual Training, second year, first, second, and third terms, *Tu., Th., at* 9. Concurrent, Physics 2. Associate Professor KESTER.

4. ELECTRICITY AND MAGNETISM. Three credit hours. Lectures and recitations. Electrical Engineering, third year, first term,

M., Tu., Th., at 10. Prerequisite, Mathematics 43, and Physics 2 and 3. Professor THOMAS.

5. PHYSICAL LABORATORY. Four credit hours. Electrical Engineering, second year, third term, *M., Tu.,* 1 *to* 4; *W.,* 1 *to* 3, *or Th., F.,* 1 *to* 4; *S.,* 8 *to* 10. Option, Manual Training, third year, first, second, and third terms, *M., Tu.,* 1 *to* 4; *W.,* 1 *to* 3. Prerequisite, Physics 2. Professor THOMAS.

Elementary manipulation. Length, mass and time measurements. Work in density, elasticity, and in heat.

6. PHYSICAL LABORATORY. Five credit hours. Electrical Engineering, third year, first and second terms, *M., Tu., W.,* 1 *to* 4, *or Th., F.,* 1 *to* 4, and *S.,* 8 *to* 11. Prerequisite, Physics 5. Concurrent, Physics 4. Professor THOMAS.

Theory and practise of magnetic and electrical measurement, including the testing and standardizing of instruments; conductivity of conductors; insulation, capacity and resistance of insulated conductors and cables; temperature co-efficients; commercial measuring and testing instruments; strength and distribution of magnetic fields; magnetic movements, permeability; work in light, including optical constants; spectroscopy; photometry of gas, electric, and other lights.

7. PHYSICAL LABORATORY. Two credit hours. Mechanical Engineering, second year, second term, *M., Tu.,* 1 *to* 3, *or Th., F.,* 1 *to* 3. Three credit hours. Mechanical Engineering, second year, third term, *M., Tu.,* 1 *to* 3, *or Th., F.,* 1 *to* 3. Three to five credit hours. First, second, and third terms. Elective. Concurrent, Physics 2.

9. PHYSICAL LABORATORY. Three to five credit hours. A second year's work in Physical Laboratory. Elective. Prerequisite, Physics 6 or 7.

ROMANCE LANGUAGES AND LITERATURES

(Office, Room 305, University Hall.)

PROFESSOR BOWEN, ASSOCIATE PROFESSOR BRUCE, ASSISTANT PROFESSOR INGRAHAM, ASSISTANT PROFESSOR PEIRCE, MR. EWINGTON

I. FRENCH

1. ELEMENTARY FRENCH. Four credit hours. Three terms. Grammar: Fraser and Squair's or equivalent. Reader: Aldrich and Foster's, or Bowen's First Scientific. Historical and narrative prose; one or more prose comedies. Sec. I, *M., Tu., Th., F., at* 9 (Arts only). Sec. II, III, and IV, *M., Tu., Th., F., at* 10. Sec. V, *M., Tu., Th., F., at* 11 (Ag. and Engin. only). Sec. VI, and VII, *Tu., W., Th., F., at* 2. All instructors in the department teach one or more sections of this course.

French 1 may be taken by students who enter with no entrance credits in French.

2. MODERN FRENCH LITERATURE. Four credit hours. Sec. I, and II, *M., Tu., Th., F., at* 10. Sec. III, *M., Tu., Th., F., at* 11. Prerequisite, Course 1, or two units entrance French. Associate Professor BRUCE, Assistant Professor PEIRCE, Mr. EWINGTON.

The study of the literature as such now taken up. The work of the year includes the following subjects: (1) Contes; (2) The Novel (Balzac or Hugo); (3) Lyric Poetry (Bowen's Modern French Lyrics); (4) Romantic Drama (Hugo). Prose Composition. Systematic attention given to syntax and idiom. Lectures supplement the work. Private reading required. French 2 should be taken by Engineering students who enter with two units entrance French.

3. SCIENCE READING. Four credit hours. Third term. *Tu., W., Th., F., at* 2. Prerequisite, Course 2, first and second terms. Assistant Professor PEIRCE.

A course of rapid reading introductory to the vocabulary of scientific literary. French 3 must be taken by all Engineering students who take French 2 the first and second terms.

II. SPANISH

1. ELEMENTARY SPANISH. Four credit hours. Three terms. Grammar: (Hill's and Ford's or Edgren's), and Ingraham's Victoria y Otros Cuentos. Easy prose and plays. Composition and conversation. Sec. I, *M., Tu., Th., F., at* 9. Sec. II, *M., Tu., Th., F., at* 11. Sec. III, and IV, *Tu., W., Th., F., at* 2. Assistant Professor INGRAHAM, Assistant Professor PEIRCE, Mr. EWINGTON.

Spanish 1 may be taken by students who enter with no entrance credits in Spanish.

2. MODERN SPANISH LITERATURE. Four credit hours. Three terms. *Tu., W., Th., F., at* 3. Prerequisite, Course 1 or two units entrance Spanish. Assistant Professor INGRAHAM.

The Modern Novel and Drama. Lectures covering a survey of the literature. Composition and conversation continued. Spanish 2 should be taken by Engineering students who enter with two units entrance credit in Spanish.

SHOP WORK

(See Industrial Arts.)

SPANISH

(See Romance Languages.)

GENERAL INFORMATION

THE STILLMAN W. ROBINSON FELLOWSHIP

The Stillman W. Robinson Fellowship in Engineering, endowed by Emeritus Professor Robinson for the encouragement of graduate research work in engineering, provides three hundred ($300.00) dollars annually, and is open to graduates in Mechanical, Civil, and Electrical Engineering. Any student to whom this fellowship is awarded must devote his entire time to the work, which shall amount to at least sixteen hours per week, of which at least eight shall be in the line of original research or investigation.

This fellowship will be awarded on the Friday preceding Commencement Day. All applications must be filed with the committee on or before the first of June of the same year, and much include a general outline of the course of study and research proposed. This must show a definite object to be attained. The application may be for one or two years, preference being given to candidates electing the two-year course. No one will be registered for this graduate course of research who does not satisfy the committee of the Faculty that he has the necessary capacity, fitness, and preparation to pursue the work with advantage, and promise of ultimate success.

Great importance will be attached not only to the course laid out to be pursued by the applicant, but to his personal fitness for the work and to his ability to prepare a dissertation or thesis respecting the same which shall be in every way a creditable production, and form a contribution to knowledge. The investigation may consist of experimental research, or of mathematical analysis, but it usually will be expected to embrace both forms of study. By the beginning of the first year the student must have prepared and submitted a well-defined course, and have registered for this fellowship. Throughout the course of study the student will proceed under the care of the professor who has charge of the line of work being pursued, the same consisting of occasional consultation, instead of recitations.

Students completing the two-year graduate course under the conditions of this fellowship will receive the degree of D. M.E., D. C.E., or D. E.E., according to the course taken. Students electing and completing a one-year course will receive the corresponding Master's degree.

The applications for this fellowship, the approval of the courses of study, the acceptance of the theses, and the recommendations for degrees, are to be passed upon by a committee of the Faculty consisting of the President of the University, the Dean of the College of Engineering, and the professors of Mechanical Engineering, Experimental Engineering, Civil Engineering, Electrical Engineering, and Mathematics.

FEES AND EXPENSES

GENERAL CHARGES

All term dues must be paid at the opening of each term as a condition of admission to classes.

Incidental Fee.—A charge of six dollars a term, or eighteen dollars a year, is made against all students, under the head of incidental expense. In the case of former students, if this fee is not paid until the second day of the term, one dollar will be added, and for each succeeding day of delinquency, fifty cents will be added.

Tuition.—Tuition is free in the College of Engineering.

Laboratory Fees.—Students in all laboratory courses are required to pay a flat fee of one dollar per term for each laboratory course taken. The sums thus derived are to cover in part the loss and deterioration of the expensive instruments used by them. In addition, an effort is made in each department to assess upon the students of each laboratory course the cost of the supplies and materials consumed by them. These fees vary considerably in different departments, and they are generally collected in the form of cash advances when the student enters, the unexpended balance being returned to him at the end of the term.

In those departments where the laboratory work is chemical, the student buys a card for five dollars at the beginning of the course, and from that card is supplied with chemicals and apparatus as he needs them, the value of each purchase being punched out of the card at the time. When the card is exhausted, another must be purchased. The store room redeems all unused cards at face value. In addition a deposit of five dollars is required as security against breakage or loss of the equipment of the desks, which is not supposed to be worn out or consumed, as in the case of chemicals.

GYMNASIUM LOCKER FEE.—A fee of one dollar a term is required from those who make use of a locker in the gymnasium.

CADET UNIFORMS.—The uniform with which the members of the regiment are required to provide themselves costs (without overcoat) about fourteen dollars. It is quiet in pattern, and is designed to be worn in place of civilian dress.

GRADUATION FEE.—A fee of five dollars, to cover expense of graduation and diploma, is required of each person receiving one of the ordinary degrees from the University, and this fee must be paid before the degree is conferred. A like fee of ten dollars is charged to each person receiving one of the higher graduate degrees.

TOTAL AMOUNT OF FEES

The element of economy on the part of the student enters somewhat into the cost of pursuing laboratory courses. For this reason it is impossible to fix accurately the costs for a term or a year. In pursuing the courses of the College of Engineering, it is not likely that a student could get through a year's work with an expenditure in fees of less than thirty ($30.00) dollars, nor is it likely that the amount would ever exceed fifty ($50.00) dollars, except in cases of fines being assessed for gross carelessness or needless destruction of property.

ROOMS AND BOARD

Boarding clubs are formed in the neighborhood of the University. Furnished rooms are rented at one dollar to a dollar and a half a week for each student, and the cost of table board is two dollars and seventy-five cents to three dollars and a half a week.

Board with furnished rooms can be obtained in private families, within convenient distance of the University, at rates varying from three and a half to five dollars per week. The ruling rate may be taken as four dollars.

ESTIMATE OF EXPENSES

	Low	*Average*	*High*
Incidental fees	$ 18 00	$ 18 00	$ 18 00
Laboratory fees	15 00	30 00	54 00
Books and stationary...	15 00	25 00	50 00
Room	35 00	45 00	75 00
Board	100 00	126 00	180 00
Laundry	10 00	20 00	30 00
Miscellaneous	10 00	30 00	75 00
Uniform	14 00	14 00	14 00
	$217 00	$308 00	$496 00

SELF SUPPORT

There is considerable amount of work upon the farm and in the shops and laboratories of the University which may be assigned to students on application. Preference is given to those studying Agriculture or one of the Engineering courses. *The University cannot promise work to all applicants.* Many students find work in private families, in offices, and in various occupations, by means of which they defray at least a portion of their expenses. A person of ability and energy, who is master of a trade or who can do good work of any kind, can generally find remunerative employment. It has seldom been known that any student of ordinary energy and industry was obliged to leave the University because of a lack of money for necessary expenses, after having been sixty days on the ground—or long enough to inform himself as to the opportunities for securing employment. As an accommodation the executive office co-operates as far as possible in this matter. The Y. M. C. A. offers its services in helping young men to secure employment. Very much depends, however, on the individual's power of initiative. Students should not come to the University expecting others to find places for them. They should report to the executive office from time to time as to their needs and their work. This will enable the authorities to be more helpful than otherwise would be possible.

A student devoting much of his time to earning his way will be unable to carry successfully the full amount of collegiate work. Such students should apply for the privilege of carrying reduced work. This, of course, means that the time required to obtain a degree will be extended to five or more years, according to the amount of work successfully carried each year.

SPECIAL REGULATIONS

REGISTRATION.—All students are required to register and pay their term fees on or before the first day of each term between the hours of 8 a. m. and 12 m., or between 1 and 4 p. m., central standard time. No candidate for graduation will be permitted to register for the second term of his graduating year, except upon presentation to the Bursar of the President's certificate that his thesis subject has been announced and approved.

AMOUNT OF WORK.—No student is permitted to take less than fifteen credit hours a week of any sort of work, except by special permission, and no student will be permitted to take more than the regular work of the class to which he belongs, who has not passed all his work for the preceding term.

CREDIT HOURS.—"Two consecutive hours of practical or experimental work in any department shall be regarded as the equivalent of one hour of class-room exercise; but when no outside work is required in addition to the laboratory work, then three hours of laboratory work may be required as equivalent to one credit hour; and in general not more than three hours of the student's time, including class hours, shall be required for each credit hour."

CONSULTATION.—For consultation in regard to their status as members of the College of Engineering, or for the filing of petitions, changes of course, changes of class cards, adjustment of schedules and similar needs, students will apply to the Secretary, Mines Building, Room 233, from 10 to 11 a. m.

DESCRIPTION OF SUBJECTS ACCEPTED FOR ADMISSION

(A) ENGLISH GROUP

English Composition and Rhetoric. One unit. Each applicant must be able to write clear and correct English, and no applicant will be accepted in English whose work is seriously defective in spelling, punctuation, grammar, and paragraph structure. The proper preparation for this part of the requirement is practice in composition through the four preparatory years, with correction of themes by the teacher and revision by the pupil. Subjects for themes should be taken from the books prescribed for general reading below and also from the pupil's observation and experience. Practice should be afforded in writing narrative, descriptive, exposition and argumentation. Applicants should be familiar with those principles of Rhetoric which are most helpful in elementary composition; viz., the principles of sentence structure, outlining, paragraphs, and choice of words. The amount and kind of work required is indicated in Scott and Denney's Elementary Composition and Composition-Literature.

English Classics. One unit. (a) A thorough knowledge of the subject-matter, form, and structure of Shakespere's Macbeth. Milton's Lycidas, Comus, L'Allegro, Il Penseroso; Burke's Speech on Conciliation with America (or Washington's Farewell Address and Webster's First Bunker Hill Oration); Macaulay's Life of Johnson (or Carlyle's Essay on Burns. (b) A general knowledge of the substance of ten books selected from the following groups: Group 1 (two to be selected), Shakespere's As You Like It, Julius Cæsar, Merchant of Venice, Twelfth Night, Henry the Fifth; Group 2 (one to be selected), Bunyan's Pilgrim's Progress, part 1; Bacon's Essays, The Sir Roger de Coverley Papers in The Spectator, Franklin's Autobiography; Group 3 (one to be selected), Chaucer's Prologue, selections from Spenser's Faerie Queene, Pope's Rape of the Lock, Goldsmith's Deserted Village, Palgrave's Golden Treasury, first series, books ii and iii, with special attention to Dryden, Collins, Gray, Cowper, and Burns; Group 4 (two to be selected), Hawthorne's House of the Seven Gables, Thackeray's Henry Esmond, George Eliot's Silas Marner, Dickens' A Tale of Two Cities, Scott's

Ivanhoe, Quentin Durward, Goldsmith's Vicar of Wakefield, Mrs. Gaskell's Cranford, Blackmore's Lorna Doone; Group 5 (two to be selected), Emerson's Essays (selected), Ruskin's Sesame and Lilies, Irving's Sketch Book, Carlyle's Heroes and Hero Worship, DeQuincey's Joan of Arc and the English Mail Coach, Lamb's Essays of Elia; Group 6 (two to be selected), Palgrave's Golden Treasury, first series, book iv, with special attention to Wordsworth, Keats, and Shelley, Coleridge's Ancient Mariner, Lowell's Vision of Sir Launfal, Scott's Lady of the Lake, Poe's Poems, Tennyson's Gareth and Lynette, Lancelot and Elaine, The Passing of Arthur, Arnold's Sohrab and Rostum, Byron's Mazeppa, The Prisoner of Chillon, Macaulay's Lays of Ancient Rome, and Browning's Cavalier Tunes, Lost Leader, How They Brought the Good News, Evelyn Hope, Home Thoughts from Abroad, Home Thoughts from the Sea, Incident of the French Camp, The Boy and the Angel, One Word More, Herve Riel, Pheidippides.

English Literature. One unit. A good knowledge of the leading facts in the history of English Literature, as given in Scudder's English Literature, Johnson's History of English and American Literature, or the Introductions by Pancoast, Painter, Halleck, or Newcomer; together with the reading of representative works of literature. This may be offered in lieu of the work in English Classics.

(B) HISTORY GROUP

Civil Government. One-half unit. A good knowledge of the origin, principles, forms, and powers of the national, state, and local governments is expected. Fiske's Civil Government, with a special study of the state from which the student comes, may serve to indicate the amount and kind of knowledge sought.

United States History. One-half or one unit. A good knowledge of the main facts and features of American History, especially of the period since 1750, is expected. McLaughlin's History of the American Nation, Montgomery's Student's American History or Hart's Essentials in American History will serve to show the kind and amount of knowledge sought. No credit upon certificate will be accorded in this subject for work done below the ninth grade.

General History or Mediaeval and Modern History. One or one-half unit. Adams' European History or Harding's Essentials in Mediæval and Modern History, Myers' Mediæval and Modern History (revised), or an equivalent.

GREEK AND ROMAN HISTORY. One-half or one unit. Botsford's Ancient History for Beginners, or West's Ancient World, or Wolfson's Essentials in Ancient History, or an equivalent.

ENGLISH HISTORY. One-half or one unit. Higginson and Channing's English History for Americans, or Walker's Essentials in English History, or Cheyney's Short History of England, or an equivalent.

(C) MATHEMATICS GROUP

ALGEBRA. One unit. Wells, Wentworth, Milne, or an equivalent. Special attention should be given to the four fundamental operations (single and system), factoring, highest common factor, lowest common multiple, fractions and fractional equations, involution, evolution, surds, complex quantities, quadratic equations solved by factoring, by completing the square and the general formula.

ALGEBRA. One-half unit. A thorough review of the work above named, irrational equations, simultaneous quadratic equations, higher equations solvable by factoring, ratio, proportion, progressions, theory of exponents, binominal theorem for positive integral exponents, and use of five-place tables of logarithms. It is recommended that this work be taken in the last year of the high school course.

GEOMETRY. One unit. Venable, White, Wells, Wentworth, Beman and Smith, or an equivalent. Plane geometry with solution of originals.

GEOMETRY. One-half unit. Solid and spherical geometry, with solution of originals given in the text-books named above.

(D) SCIENCE GROUP

PHYSICS. One unit. Carhart and Chute's Elements, Gage's Elements, Avery's Elements, Millikin and Gale's First Course in Physics, or an equivalent. Four recitation periods per week, including drill on simple numerical problems is recommended. A laboratory period of not less than two hours per week, to accompany the work of the text-book, is strongly urged, but is not required for the present.

PHYSICAL GEOGRAPHY. One-half or one unit. Tarr's, Dryer's, Davis', or Gilbert and Brigham's Physical Geography. The class work should be accompanied by a study of the physiographic forms and processes to be seen near the school.

BOTANY. One-half or one unit. Equivalent of the work outlined in an elementary text-book (such as Coulter's, Bailey's, Bergin's, Andrews', Leavitt's, Barnes', Atkinson's, or Stevens'), and of a small handbook of the local flora (Kellerman's Spring Botany).

Chemistry. One unit. McPherson and Henderson's Elementary Study of Chemistry, together with the Exercises in Chemistry arranged to accompany the same, or an equivalent. The course should consist of at least three recitations and four hours of laboratory work weekly throughout the year.

Physiology. One-half unit. Colton's Briefer Course, or an equivalent. No credit will be accorded in this subject for work done below the ninth grade.

Zoology. One-half or one unit. Jordan, Kellogg, and Heath's Animal Studies, Kellogg's Elementary Zoology, Davenport's Introduction, or equivalents, with laboratory or field work.

Geology. One-half unit. Brigham's, Dana and Rice's (revised), Tarr's, or LeConte's may be used as texts. The recitations should be supplemented by study of the geological phenomena and formations found in the vicinity of the school.

(E) FOREIGN LANGUAGE GROUP

Latin. Two units. Pronunciation (Roman method); Grammar (an exact knowledge of the inflections). Cæsar, the first four books of the De Bello Gallico. Third unite. Cicero, six orations of Cicero, including Pro Lege Manilia. Fourth unit. Vergil, the first six books of the Æneid with prosody; and prose composition, Daniel, Collar, Bennett, Dodge and Tuttle, or Pearson, entire. Latin cannot be continued as a university study unless at least three units are offered for admission. Pupils should be trained to the systematic use of one of the standard Latin grammars from the outset.

Greek. Two units. Grammar (Goodwin's preferred) and Prose Composition; or White's First Creek Book. Reading: The first three books of Xenophon's Anabasis. A third unit will be allowed for preparation in the fourth, fifth, and sixth books of the Anabasis and three books of Homer's Iliad, and a fourth unit for additional reading in Greek.

German. Two units. The pupil must possess a good pronunciation and be able to read or to translate at sight easy narrative prose, showing an exact and ready knowledge of the declensions and conjugations of the language. The ordinary principles of syntax and of word-order must be thoroughly mastered and such knowledge shown by the ability to translate easy sentences into German. Some three hundred pages of simple prose and poetry must be read.

Four units. In addition to the above, the applicant must have had two years more of instruction, including the reading of from four to five hundred pages of standard prose and at least one of Schiller's dramas, with not less than fifty pages of work in prose composition. One-half of this latter amount may be offered for a third unit.

FRENCH. Two units. Applicants should be able to pronounce French accurately, to read at sight easy French prose, to put into French simple English sentences taken from the language of everyday life or based upon a portion of the French text read, and to answer questions on the rudiments of the grammar as defined below. During the first year the work should comprise: (1) Careful drill in pronunciation; (2) the rudiments of grammar, including the inflection of the regular and the more common irregular verbs, the plural of nouns, the inflection of adjectives, participles, and pronouns; the use of personal pronouns, common adverbs, prepositions, and conjunctions; the order of words in the sentence and the elementary rules of syntax; (3) abundant easy exercises, designed not only to fix in the memory the forms and principles of grammar, but also to cultivate readiness in the reproduction of natural forms of expression; (4) the reading of from 100 to 175 duodecimo pages of graduated texts, with constant practise in translating into French easy variations of the sentences read (the teacher giving the English), and in reproducing from memory sentences previously read; (5) writing French from dictation. During the second year the work should comprise: (1) The reading of from 250 to 400 pages of easy modern (nineteenth century) prose in the form of stories, plays or historical or biographical sketches; (2) constant practise, as in the previous year, in translating into French easy variations upon the texts read; (3) frequent abstracts, sometimes oral and sometimes written, of portions of the text already read; (4) writing French from dictation; (5) continued drill upon the rudiments of grammar, with constant application in the construction of sentences; (6) mastery of the forms and use of pronouns, pronominal adjectives, of all but the rare irregular verb forms, and of the simpler uses of the conditional and subjunctive.

Three units. In addition to the above, applicants must have had a third year of instruction and should be able to read at sight ordinary French prose or simple poetry, to translate into French a connected passage of English based on the text read, and to answer questions involving an adequate knowledge of syntax.

Four units. In addition to the above, applicants must have had a fourth year of instruction, and should be able to read at sight, with the help of a vocabulary of special or technical expressions, difficult French not earlier than that of the seventeenth century; to write in French a short essay on some simple subject connected with the works read; to put into French a passage of easy English prose and to carry on a simple conversation in French.

SPANISH. Two units. Applicants should be able to pronounce Spanish accurately, to read at sight easy Spanish prose, to put in Spanish simple English sentences taken from the language of everyday life or based upon a portion of the Spanish text read, and to answer questions on the essentials of the grammar. The first year should be spent mainly on the grammar, with easy reading and oral practise; the second devoted to reading good modern Spanish, with grammatical analysis and exercises in writing. The texts read should be chiefly narrative and conversational prose, including one or more prose dramas of the present age.

Three units. In addition to the above, applicants must have had a third year of instruction, and should be able to read at sight ordinary Spanish prose or simple poetry, to translate into Spanish a connected passage of English based on the text read, and to answer questions involving an adequate knowledge of syntax.

Four units. In addition to the above, applicants must have had a fourth year of instruction, and should be able to read at sight, with the help of a vocabulary of special or technical expressions, difficult Spanish, whether prose or poetry; to write in Spanish a short essay on some simple subject connected with the works read; to put into Spanish a passage of easy English prose, and to carry on a simple conversation in Spanish.

LIST OF ACCREDITED AND RECOGNIZED SCHOOLS IN OHIO.

Accredited schools are those four-year secondary schools whose courses of study have been found by inspection to be capable of satisfactorily preparing students for all colleges of the University.

Recognized schools are those three or four-year secondary schools whose courses of study are not capable of preparing students for all colleges of the University, but which have been found by inspection to cover satisfactorily 10 units of the requirements for admission.

These lists are subject to change from year to year as schools are revisited. Persons are advised, therefore, to consult the latest bulletins and catalogues of the University. A shows that a school is accredited; R, that it is recognized.

School	Superintendent	Principal
Akron, A	H. V. Hotchkiss	D. C. Rybolt
Alliance, R	J. E. Morris	J. E. Vaughan
Andover, R	S. A. Harbourt	Mary McDonald
Arcanum, R	C. E. Thomas	H. L. Senseman
Ashland, R	E. P. Dean	F. C. Clark
Ashtabula, A	E. A. Hotchkiss	Lillian Kurtz
Ashville, R	Stanley Lawrence	
Athens, A	B. O. Skinner	Zella Foster
Baltimore, R	J. H. Horton	J. J. Wagner
Barberton, R	J. M. Carr	G. M. Korns
Barnesville, A	W. R. Butcher	A. J. Gerber
Batavia, R	B. S. Timmons	
Bedford, R	H. L. Rawdon	Miss G. E. Thomas
Bellaire, A	J. R. Anderson	Alice Cunningham
Bellefontaine, A	J. W. MacKinnon	Annie A. Price
Bellevue, R	E. F. Warner	H. C. Bates
Bethel Township, Clark Co., R	Alfred Ross	Irene Dornblaser
Bethel Township Miami Co., R	R. W. Crist	Walter Peoples
Blanchester, R	C. L. Leahy	Elizabeth Chaney
Bluffton, R	C. A. Arganbright	I. W. Geiger
Bowling Green, A	N. D. O. Wilson	
Bryan, A	J. W. Wyandt	Orville Smith
Bucyrus, A	W. N. Beethan	C. H. Miller
Cadiz, R	J. R. Lehman	S. L. Eby
Caldwell, R	C. J. Foster	Patrick Henry
Cambridge, A	H. Z. Hobson	John H. Harding
Camden, R	J. L. Fortney	L. D. Brouse
Canal Dover, A	F. P. Geiger	A. J. Huffman

School	Superintendent	Principal
Canal Winchester, R	A. A. McEndree	
Canton, A	John K. Baxter	Chas. A. Armstrong
Carey, R	A. J. Nowlan	Mattie Myers
Carthage, R	C. A. Wilson	Louise Sherer
Celina, R	S. Wilkin	J. W. Pogue
Chardon, A	W. R. Davis	Jessie King
Chillicothe, A	M. E. Hard	W. H. Rice
Cincinnati—	F. B. Dyer	
Hughes, A		E. W. Coy
Walnut Hills, A		W. T. Harris
Woodward, A		E. D. Lyon
Cin. Tech. School, A		L. M. Ballou
Circleville, A	C. L. Boyer	W. E. Sealock
Cleveland—	W. H. Elson	
Central, A		Edward L. Harris
East, A		B. U. Rannells
Lincoln, A		James W. McLane
South, A		G. A. Reutenik
West, A		C. L. Lynch
Glenville, A		H. H. Cully
Cleveland Heights, A	C. A. Tilden	C. A. Tilden
Clintonville, R	W. S. Jennings	
College Corner, R	C. E. Gillespie	Edith Francisco
Collinwood, A	Frank P. Whitney	F. C. Rulon
Columbus—	Jacob A. Shawan	
Central, A		W. M. Townsend
East, A		F. B. Pearson
North, A		C. D. Everett
South, A		C. S. Barrett
Columbus School for Girls, A		Miss G. L. Jones Miss Alice Gladden
Columbus Grove, R	J. T. Begg	M. L. Allstetter
Conneaut, R	Calvin T. Northrop	Louise E. Kahler
Corning, R	F. W. Huston	
Coshocton, A	Herman S. Piatt	C. E. Bryant
Covington, R	L. J. Bennett	D. H. Sellers
Cumberland, R	G. E. Bell	W. S. Kingston
Cuyahoga Falls, R	R. W. Solomon	H. O. Bolich
Dayton, A	J. W. Carr	Chas. L. Loos, Jr.
Defiance, R	F. E. Reynolds	
Delaware, A	W. McK. Vance	Mrs. A. C. Dackerman
Delphos, A	T. W. Shimp	I. F. Matteson
Delta, R	G. W. Hoffman	Viola Wilkins
DeGraff, R	N. H. Stull	
Dennison, R	W. H. Angel	A. J. Fry
Dresden, R	E. E. Smock	Blanche E. Baker
East Cleveland, A	W. H. Kirk	
East Liverpool, A	R. E. Rayman	Florence Updegraff
Eaton, A	F. B. Bryant	John O'Leary
Elyria, A	W. R. Comings	H. M. Ebert
Euclid, R	H. D. Rankin	Mary E. Gould

School	Superintendent	Principal
Fayette, R	C. D. Perry	E. N. Hoover
Findlay, A	J. W. Zeller	J. F. Smith
Fort Recovery, R	James Ross	(Mrs.) J. A. Hunter
Fostoria, A	S. H. Layton	Ida McDermott
Franklin School, (Cincinnati), A		Joseph E. White G. S. Sykes
Fredericktown, R	W. W. Borden	Anna B. Beattie
Fremont, A	J. E. Collins	H. M. Lowe
Friends' Boarding School (Barnesville), R		B. J. Thomas
Galion, A	I. C. Guinther	Louise John
Gallipolis, A	H. E. Conard	L. W. McKinnon
Garrettsville, R	E. F. Robison	
Geneva, R	J. E. Fitzgerald	E. A. Barnes
Georgetown, A	A. F. Waters	T. E. Hughes
Germantown, A	C. W. McClure	S. M. Heitz
Gibsonburg, R	S. H. Benson	Mary E. Baker
Glendale, A	E. H. Foster	Mary S. Evans
Grand River Institute, A		O. J. Luethi
Granville, R	J. R. Clements	Flora Hoover
Greenfield, A	E. W. Patterson	Roy Harris
Greenville, A	W. S. Rowe	J. L. Selby
Greenwich, A	J. H. Diebel	Ethel M. Hurst
Grove City, R	A. C. Fries	C. F. Neiswander
Groveport, R	M. C. Warren	J. F. Paxton
Hamilton, A	Darrell Joyce	W. P. Cope
Harmony Township (Clark Co.), R	David Neer	Carlton Henry
Hartwell, A	J. S. Trisler	J. C. Mauchley
Harrison, R	Thos. P. Pierce	Mary A. Curran
Harrison Township, (Mont. Co.), R	D. W. Klepinger	A. E. Clagett
Hicksville, R	J. M. Beck	C. C. Nardin
Highland, R	C. W. Johnson	Bessie L. Smith
Hilliards, R	Chauncey Lawrence	J. B. Phillips
Hillsboro, A	F. H. Warren	W. E. Arter
Home City, R	J. O. Falkenburg	Inez M. White
Ironton, A	S. P. Humphrey	T. Howard Winters
Jackson, A	J. E. Kinnison	M. A. Henson
Jefferson, A	H. S. Foote	Mary I. Hoskins
Kent, R	R. P. Clark	W. A. Walls
Kenton, A	N. E. Hutchinson	
Kingsville, R	E. W. Hamblin	
Kirtland, R		
Lakeside, A	H. O. Hannah	Margaret Hull
Lakewood, A	J. M. H. Frederick	H. W. Kennedy
Lancaster, A	H. A. Cassidy	W. C. Brashares
Lebanon, R	J. M. Hamilton	L. F. Coleman
Leetonia, R	J. W. Moore	L. A. Herdle

School	Superintendent	Principal
Leipsic, R	W. S. Sackett	Florence B. McClure
Lima, A	J. A. Davidson	S. Steffens
Lisbon, R	R. C. Schroth	
Lockland, A	S. T. Dial	Howard Hollenbach
Logan, A	H. F. Silverthorn	
London, A	Wm. McClain	Marion Schlesinger
Lorain, R	A. C. Eldredge	D. J. Boone
Madison, R	Geo. C. Von Beseler	Lois Ellet
Madison Township (Pickaway Co.), R		
Madisonville, A	C. M. Merry	(Mrs.) J. M. Bryan
Mad River Township (Enon Village), R	J. R. Clark	O. P. Hause
Malta, R	George M. Strong	L. E. Coulter
Mansfield, A	H. H. Helter	Harland E. Hall
Marietta, A	J. V. McMillan	W. H. Maurer
Marion, A	H. L. Frank	C. H. Winans
Martins Ferry, A	L. E. York	O. C. Hursch
Marysville, A	L. B. Demorest	
Massillon, A	C. L. Cronebaugh	
Mechanicsburg, A	J. W. Bowen	L. H. Seigler
Medina, A	J. R. Kennon	Fannie E. Thomson
Miamisburg, A	W. T. Trump	Hardy Jackson
Middletown, A	Arthur Powell	Geo. C. Stahl
Montpelier, R	T. G. Paseo	F. W. Leist
Mt. Gilead, R	C. B. Stoner	F. J. Ryan
Mt. Sterling, R		Cathryn Webber
Mt. Vernon, A	J. S. Alan	R. E. Offenhauer
Napoleon, A	P. C. Zemer	F. W. Leist
Nelsonville, A	Aaron Grady	O. C. Jackson
Newark, A	J. D. Simkins	F. Otto Williams
New Bremen, R	C. F. Limbach	J. O. Erwin
New Lexington, R	J. M. Gordon	G. A. Elliott
New London, A	W. H. Mitchell	Stella M. Townsend
New Lyme Institute, A		H. C. White
New Philadelphia, A	G. C. Maurer	G. A. Wyly
New Richmond, R		
New Vienna, R	W. C. Hutchinson	
Niles, R	F. J. Roller	W. H. C. Newington
North Baltimore, R	B. O. Martin	S. L. Eby
Norwalk, R	A. D. Beechy	James E. Cole
Norwood, A	W. S. Cadman	W. W. McIntire
Oak Harbor, R	H. H. Hoffman	(Mrs.) Sarah R. Gill
Oberlin, A	Ward Nye	J. B. Crouch
Oberlin Academy, A		J. F. Peck
Ohio Military Institute, R	A. M. Henshaw	S. P. C. Roberts
Orrville, R		
Osborne, R,	A. F. Darby	
Ottawa, R	G. J. Keinath	L. F. Gehres

School	Superintendent	Principal
Oxford Coll. Acad., R	Jane Sherzer	Catherine Cox
Painesville, A	F. H. Kendall	A. H. Mabley
Pandora (Riley Township), R	C. D. Steiner	
Pataskala, R	E. E. Atwell	J. C. Evans
Perrysburg, R	C. E. Stinebaugh	Olive Woodard
Piqua, A	J. R. Beachler	F. E. C. Kirkendall
Plain City, R	J. S. Edwards	
Pleasant Ridge, R	F. L. Simmerman	
Pomeroy, R	C. T. Coates	Dollie Hooper
Port Clinton, R	C. C. Underwood	Lillian C. Smith
Portsmouth, A	Frank Appel	W. D. Gilliland
Quaker City, R	W. G. Wolfe	J. O. Eagleson
Ravenna, R	E. O. Trescott	W. J. Dodge
Reynoldsburg, R	Arthur L. Gantz	Wm. S. Coy
Richwood, R	R. H. Allison	W. E. Shrader
Ripley, R	R. B. Smith	John W. Thalman
Sabina, R	M. J. Flannery	T. C. Madden
Salem, A	J. S. Johnson	B. F. Stanton
Salineville, R	Frank Linton	W. H. Hannum
Sandusky, A	H. B. Williams	Geo. C. Dietrich
Shelby, A	S. H. Maharry	D. J. Schaeffer
Sidney, A	Herbert R. McVay	Lee R. Dollinger
Solon, R	A. B. Horst	Charlotte Parker
Somerset, R	J. W. Davis	E. R. Beck
South Charleston, R		Stanley Zemer
Spencerville, R	Thos. J. Class	E. S. Bolton
Springfield, R	Carey Bogess	C. C. Patterson
Steubenville, A	R. L. Ervin	J. Vernon Cox
St. Mary's, A	C. C. McBroom	J. Howard Spohn
St. Paris, R	James H. Fortney	Florence Hunter
St. Raphael's Sc'l A,		Sister Rosetta
Tiffin, A	C. A. Krout	H. H. Frazier
Tippecanoe City, R	Orville Crist	E. R. Rike
Toledo, A	Chas. L. Van Cleve	Wm. B. Guitteau
Troy, A	C. W. Cookson	Edward M. Traber
Uhrichsville, R	L. E. Everett	C. W. Jackson
Union City (Ind.), A	O. H. Blossom	
Urbana, A	I. N. Keyser	H. N. Morton
Urbana Univ., A	Frank A. Gustafason	Russell Eaton
Ursuline Acad. (Brown Co.), R		Sister M. Baptista
Upper Sandusky, R	R. J. Kiefer	Glenn E. True
Utica, R	F. P. Householder	
Van Wert, A	J. P. Sharkey	Orrin Bowland
Wadsworth, R		W. A. Franks
Wapakoneta, A	Charles Haupert	Mary O. Conrath
Warren, A	C. E. Carey	F. E. Ostrander
Washington C H., A	James T. Tuttle	
Wauseon, A	C. J. Biery	
Waverly, R	J. F. Henderson	G. W. Caldwell

School	Superintendent	Principal
Wellington, A	R. H. Kinnison	Elizabeth Day
Wellston, A	E. S. McCall	J. W. Whiteside
Wellsville, A	J. L. MacDonald	Ruby C. Mason
West Alexandria, R	L. D. Brouse	Clara Smith
Westerville, R	J. P. West	J. F. Nave
West Jefferson, R	L. C. Dick	
West Milton, R	F. B. Harris	Mary E. Thomas
West Unity, R	W. A. Salter	Adah Weiser
Willoughby, A	S. D. Shankland	Edward M. Ottis
Wilmington, R	E. P. West	F. P. Blair
Woodsfield, R	C. S. McVey	H. O. Young
Wooster, A	D. L. Thompson	Laura B. Kean
Worthington, R	Harvey S. Gruver	J. J. McDonald
Wyoming, A	C. S. Fay	Evelyn M. Prichard
Xenia, A	Edwin B. Cox	Geo. J. Graham
Youngstown, A	N. H. Chaney	Wells L. Griswold
Zanesville, A	W. D. Lash	Ira C. Painter

ACCREDITED SCHOOLS OF OTHER STATES

Colorado—Canon City; Cripple Creek; Denver—West Side, North Side; Durango; Golden; Grand Junction; Greeley; Idaho Springs; Leadville; Longmont; Loveland; Trinidad.

Illinois—Alton; Aurora—East, West; Bloomington; Blue Island; Champaign; Chicago—Austin, Calumet, Curtis, Englewood, Hyde Park, Jefferson, John Marshall, Joseph Medill, Lake, Lake View, North West Div. (Tuley), R. T. Crane (Man. T'g), Robert A. Waller, South Chicago, Wendell Phillips, William McKinley; Chicago Heights; Clyde (Morton Tp.); Danville; Decatur; De Kalb Tp.; Dixon; Elgin; Elgin Academy; Evanston Academy (N. W. Univ.); Evanston Tp.; Francis W. Parker; Freeport; Harvey (Thornton Tp.); Highland Park (Deerfield Tp.); Joliet Tp.; Kankakee; Kewanee; La Grange Tp.; La Salle-Peru Tp.; Moline; New Trier Tp. (Kenilworth); Northwestern Medical Academy; Oak Park Tp.; Ottawa Tp.; Peoria; Polo; Pontiac Tp.; Princeton Tp.; Quincy; Rockford; Rock Island; Savanna Tp.; Springfield; Sterling Tp.; Streator Tp.; Waukegan Tp.

Indiana—Elkhart; Evansville; Fort Wayne; Goshen; Howe School (Lima); Michigan City; Shortridge (Indianapolis); South Bend.

Iowa—Boone; Burlington; Cedar Rapids; Clinton; Corning; Council Bluffs; Davenport; Denison; Des Moines—East, North, West; Dubuque; Fort Dodge; Grinnell; Ida Grove; Iowa City; Keokuk; Le Mars; Marshalltown; Mason City; Missouri Valley;

Oskalooso; Ottumwa; Red Oak; Sheldon; Sioux City; Vinton; Washington; Waterloo—East, West.

KANSAS—Arkansas City; Fort Scott; Iola; Junction City; Kansas City; Lawrence; Leavenworth; Sumner Co. (Wellington); Topeka; Wichita.

MICHIGAN—Adrian; Albion; Alpena; Ann Arbor; Battle Creek; Bay City (East Side); Bay City (West Side); Benton Harbor; Benton Harbor Col. Inst.; Bessemer; Cadillac; Calumet; Coldwater; Detroit—Central, Delray, Eastern, Western, Woodmere, Home and Day, University; Dowagiac; Escanaba; Ferris Institute; Flint; Grand Rapids; Hancock; Holland; Houghton; Ionia; Ironwood; Iron Mountain; Ishpeming; Jackson; Kalamazoo; Lake Linden; Lansing; Manistee; Manistique; Marshall; Marquette; Menominee; Michigan Military Academy; Michigan Seminary; Monroe; Muskegon; Mt. Clemens; Mt. Pleasant; Negaunee; Owosso; Pontiac; Port Huron; Saginaw (East Side); Saginaw (West Side); Sault Ste. Marie; South Haven; St. Johns; St. Joseph; Three Rivers; Traverse City; Wyandotte.

MINNESOTA—Albert Lea; Anoka; Austin; Crookston; Duluth Central; Faribault; Fergus Falls; Hastings; Little Falls; Mankato; Marshall; Minneapolis—Central East, North; Montevideo; Northfield; Owatonna; Rochester; St. James; St. Paul—Central, Humboldt; Stillwater; Virginia; Willmar.

MISSOURI—Blees Military Academy (Macon); Booneville; Carrollton; Chillicothe; Drury College Academy; Kansas City—Central, Manual Training, Westport; Kemper Military School; Kirkwood; Macon; Marysville; St. Louis—Central, McKinley, Smith Academy, Yeatman; St. Joseph; Sedalia; Trenton; Webster Groves.

NEBRASKA—Beatrice; Brownell Hall; Fremont; Grand Island; Hastings; Lincoln Academy; Lincoln; Omaha; South Omaha; York.

NORTH DAKOTA—Fargo; Grand Forks.

SOUTH DAKOTA—Aberdeen; Deadwood; Mitchell; Watertown; Yankton.

WISCONSIN—Antigo; Appleton; Ashland; Baraboo; Beaver Dam (Wayland Academy); Beloit; Berlin; Chippewa Falls; Eau Claire; Elkhorn; Fond du Lac; Grand Rapids; Hartford; Janesville; Kenosha; La Crosse; Lake Geneva; Madison; Maniotowoc (North); Marinette; Marshfield; Menomonie; Merrill; Milwaukee—East Division, South Division, West Division; Milwaukee-Downer Seminary; Oshkosh; Plymouth; Portage; Racine; Racine Col. Grammar School; Reedsburg; Ripon; Sheboygan; Stevens

Point; Superior, Blaine; Superior, Nelson Dewey; Tomah; Washburn; Waukesha; Waukesha (Carroll College Academy); Waupaca; Wausau; Wauwatosa; Whitewater.

ENROLLMENT*

March 6, 1908

Students in Four-Year Courses Leading to Degrees	809
Students in Short Courses not Leading to Degrees	45
Special Students	25
Total	879

CLASSIFICATION BY COURSES

Name of Course Pursued	4th year	3d year	2d year	1st year	2d yr. short	1st yr. short	Special	Total
Unclassified	....	....	....	302	....	....	....	302
Architecture	2	5	12	Unclassified	....	....	....	19
Ceramics	5	12	22		8	7	....	72
Chemical Engineering	5	12	14		....	....	....	31
Civil Engineering	31	41	69		....	....	....	141
Electrical Engineering	28	32	56		....	....	....	116
Industrial Arts	2	....	1		3	15	....	21
Manual Training	....	....	....		....	....	....	....
Mechanical Engineering	16	31	43		....	....	....	90
Mine Engineering	13	13	24		2	10	....	62
Special, Unclassified	....	....	....		....	....	25	25
Total	109	157	241	302	13	32	25	879

Note:—For list of names consult the General Catalogue of the University, which will be sent on application.

SUMMARY OF GRADUATES

ARCHITECTURE (C. E. in Arch.)	6
CERAMICS (Cer. E.)	12
CHEMISTRY (B. Sc. in Chem.)	32
CIVIL ENGINEERING (C. E.)	185
ELECTRICAL ENGINEERING (M. E. in E. E.)	197
INDUSTRIAL ARTS (B. Sc. in Ind. Arts)	4
MECHANICAL ENGINEERING (M. E.)	154
MINE ENGINEERING (E. M.)	93
MASTER OF SCIENCE, CONFERRED BY COLLEGE OF ENGINEERING	2
TOTAL DEGREES CONFERRED	685
NAMES COUNTED TWICE	8
TOTAL NUMBER OF GRADUATES	677

DIRECTORY OF GRADUATES

March 14, 1908.

The University is anxious to place a copy of each annual bulletin in the hands of the graduates of the College of Engineering. It will be esteemed a favor if any alumnus who changes his residence will notify the University Editor of the new address and occupation.

A

ACKERMAN, ELI O., 1884, C. E. Station "B," Columbus, Ohio.	Engineer, Maintenance of Way Columbus Railway & Light Co.
ACKERMAN, FREMONT, 1883, C. E. Los Angeles, California.	Civil Engineer.
ALDRICH, EDGAR S., 1897, E. E. Moscow, Idaho.	Vice President and Manager Moscow Electric Light & Power Co.
ALEXANDER, C. P., 1896, E. E. Akron, Ohio.	Instructor in Physics, High School.
ALEXANDER, ST. C., 1893, E. E. Kansas City, Mo.	In Stock Yards.
ALSDORF, FRED C., 1892, E. M. Clifton, Arizona.	Superintendent, Stevens Copper Co.
ALSDORF, PERCY REED, 1896, E. M. Central City, Colorado.	Assayer and Chemist in Standard Assay Office.
ALSDORF, ROBERT C., 1904, M. E. 1508 Union St., Schenectady, N. Y.	Turbine Dept., Gen. Elec. Co.
AMES, EDWARD H., 1903, C. E. 70 N. Fourth St., Columbus, Ohio.	Contractor.
ARNOLD, EDWIN E., 1898, M. E. Wilkinsburg, Pa.	Engineer, Westinghouse Machine Co.
ASHER, CLYDE B., 1905, C. E. Bellevue, Pa.	Engineer for National Fireproofing Co.

Atkinson, Warren, 1899, M. E. 125 W. 127th St., N. Y.	Electrical Dept., New York Telephone Co.
Auld, James A., 1897, E. E. Columbus, Ohio.	Mfg. Jeweler.

B

Bailey, Ervin G., 1903, M. E. Fairmount, W. Va.	With Fairmount Coal Co.
Barcus, Miner, 1897, E. E. Schenectady, N. Y.	Engineering Dept., General Electric Co.
Barianbrock, Charles H., 1905, C. E. Cleveland, Ohio.	With King Bridge Co.
Barnaby, C. L., 1898, C. E. Fort Wayne, Ind.	Engineer Maintenance of Way Dept., G. R. & I. Ry.
Barnes, Alfred H., 1907, E. E. Columbus, Ohio.	Assistant in Physics, Ohio State University.
Barringer, L. E., 1902, E.M. Schenectady, N. Y.	In Research Dept., General Electric Co.
Barrows, Harry H., 1898, C. E. Lexington, Ky.	Division Engineer, Q. & C. Route.
Barry, William J., 1903, C. E. Doanville, Ohio.	Chief Engineer, Columbus & Hocking Coal Co.
Bartholomew, Harold C., 1906, E. E. Cincinnati, Ohio.	Student Apprentice, Allis-Chalmers Co.
Beach, David Price, 1895, C. E. Zanesville, Ohio.	Engineer Maintenance of Way, C. & M. V. Ry.
Beach, Howard L., 1904, E. E. Wilkinsburg, Pa.	Engineer, Westinghouse Elec. Mfg. Co.
Beall, Charles Roy, 1907, E. E. Wilkinsburg, Pa.	In Testing Dept., Westinghouse Elec. & Mfg. Co.
Bebout, Guy B., 1905, C. E. Columbus, Ohio.	In City Engineer's Office.
Beck, Arthur A., 1893, C. E. Columbus, Ohio.	Engineer.
Belden, Sanford B., 1895, E. M. Pittsburg, Pa.	Manager Pittsburg Office, Jeffrey Mnfg. Co.
Bell, Wakeman C., 1905, C. E. Salem, Ill.	Asst. on Engineering Corps, Chicago & Eastern Illinois R. R.
Benedict, E. W., 1904, E. E. Waterbury, Conn.	New England Eng. Co.
Berger, Edwin L., 1906, E. M. Bucyrus, Ohio.	
Berman, Samuel G., 1907, C. E. (Arch.) Calebra, C. Z., Panama.	With Building Construction Dept., Isthmian Canal Com.
Beutler, Frank E., 1906, E. E. 5029 Linden Ave., Norwood, Ohio.	Apprentice.
Biebel, Herman M., 1896, E. E. Hawthorn, Ill.	Electric Engineer, Western Electric Co.

Billings, Edward J., 1906, M. E.. St. Louis, Mo.	Fuel-Testing Plant, U. S. Geological Survey.
Bischoff, John W., 1899, E. M.. 322 I Street, S. W., Washington, D. C.	
Bissing, William, 1893, E. E.... 49 Wall St., New York City.	Patent Attorney.
Blackburn F. H., 1896, E. E.... St. Louis, Mo.	Superintendent, Columbia Incandescent Lamp Co.
Bleininger, A. V., 1901, B. Sc... Columbus, Ohio.	Associate Professor of Ceramics, Ohio State University.
Bloom, J. George, 1899, C. E..... Topeka, Kas.	Engineer Maintenance of Way, C. R. I. & P. Ry.
Boehme, Adolph J., 1901, M. E.. Sharpsville, Pa.	With Shenango Furnace Co.
Bomesberger, W. N., 1903, E. M. Byesville, Ohio.	With Willes Creek Coal Co.
Bone, E. P., 1905, E. E.......... Walnut Hills, Cincinnati, Ohio.	U. S. Inspector of Ohio River Improvement.
Boothman, Dale R., 1903, M. E. Mingo Junction, Ohio.	With Carnegie Steel Co.
Borchers, Perry E., 1907, C. E.. Cheyenne, Wyo.	Draftsman, U. S. Land Office.
Bostater, H. L., 1904, E. E...... Chicago, Ill.	With the Western Electric Co. Telephone Engineering.
Bostwick, Oliver N., 1902, C. E. Mt. Sterling, Ohio.	Farmer and Civil Engineer.
Bott, George R., 1901, M. E..... Columbus, Ohio.	Acting Instructor in Engineering Drawing, O. S. U.
Bowden, Harry W., 1900, C. E.. Mt. Vernon, Ohio.	Draftsman, Mt. Vernon Bridge Co.
Bower, Jerome G., 1897, M. E... Chicago, Ill.	Sales Agent, Pressed Steel Car Co.
Bradford, Joseph N., 1883, M. E. Columbus, Ohio.	Professor of Architecture, Ohio State University.
Brannan, T. H., 1903, C. E..... Columbus, Ohio.	Assistant City Engineer.
Brashear, Charles S., 1906, C. E. Columbus, Ohio.	With Kinnear Gager Mfg. Co.
Brashear, E. R., 1903, C. E..... Mt. Vernon, Ohio.	Draftsman, Mt. Vernon Bridge Works.
Bredbeck, Walter B., 1906, C. E. Logansport, Ind.	With Pennsylvania Lines.
Brenholts, Roy, 1907, M. E..... Columbus, Ohio.	Supervising Architect.
Bridgman, B. L., 1904, C. E...... Watertown, N. Y.	With New York Central Lines.
Brindle, Tracey, 1906, C. E..... Sandusky, Ohio.	In U. S. Engineer's Office.
Britton, Guy, 1904, C. E........ Columbus, Ohio.	City Engineer's Office.
Britton, Lloyd C., 1902, C. E.... Miami, Fla.	Asst. Engineer, Florida East Coast Ry.

BROOKS, HERBERT B., 1903, E. E. Washington, D. C.	Asst. Physicist, Bureau of Standards.
BROPHY, JAMES F., 1899, E. M. Frostburg, Md.	
BROWN, FRED W., 1888, E. M. Portland, Col.	Chemist, The Portland Cement Co.
BROWN, JOHN Q., 1898, M. E. Oakland, Cal.	Asst. General Manager and Engineer, Oakland Transit Co., and San Francisco, Oakland & St. Jose R. R.
BROWN, NEWTON H., 1893, E. E. College Station, Tex.	Professor of Physics and Electrical Engineering, A. & M. College, Texas.
BRUMLEY, DANIEL J., 1895, C. E. Chicago, Ill.	Prin. Asst. Engineer, Illinois Central R. R.
BRUNING, HENRY D., 1896, C. E. Columbus, Ohio.	Manager National Engineering Co.
BUCHENBERG, A. E., 1900, E. E. Sandusky, Ohio.	Chief Electrical Engineer, Warren Electric Mfg. Co.
BUCKMAN, A. L., 1897, E. E. Toledo, Ohio.	Superintendent of Equipment, Toledo Home Telephone Co.
BURNHAM, L. H., 1905, E. E. Pittsfield, Mass.	With Stanley Electric Co.
BURNS, JAMES F., 1891, C. E. Elizabethtown, Ky.	Engineer, Louisville & Nashville R. R.
BURRELL, GLENN S., 1904, C. E. Boston, Mass.	Asst. Engineer, U. S. Navy Yard.
BYGATE, HARRY G., 1899, M. E. McKeesport, Pa.	With Monongahela Furnaces and Steel Works of National Tube Co.

C

CALKINS, GEORGE H., 1895, E. E. New Haven, Conn.	Manager of New Haven Office of General Electric Co.
CAMERON, HARRY E., 1901, C. E. Wilkinsburg, Pa.	In Designing and Estimating Dept., McClintic Marshall Construction Co.
CAMERON, GAYLOR M., 1904, E. E. Cleveland, Ohio.	In Engineering Dept., Cleveland Electric Ry. Co.
CAPRON, M. F., 1888, M. E. Elyria, Ohio.	Mechanical Engineer.
CARR, HUGH STANLEY, 1896, E. E. West Duluth, Minn.	Chief Engineer, American Carbolite Co.
CARROLL, PATRICK H., 1894, E. M. Herrin, Ill.	Superintendent, Big Muddy Coal & Iron Co.
CARSON, SAMUEL K., 1895, E. E. Iloila, P. I.	Chief Surgeon, Philippines.
CARTZDAFNER, R. E., 1903, M. E. Columbus, Ohio.	Kilbourne-Jacobs Co., Railway Construction.
CASE, LEWIS B., 1906, B. Sc. (Chem.) West Carrolton, Ohio.	Chemist, Friend Paper Co.

Cavanaugh, A. F., 1900, M. E. East Pittsburg, Pa.	With W. E. & M. Co.
Cavin, Frank T., 1902, E. E. Schenectady, N. Y.	Testing Dept., General Electric Co.
Cellarius, Fred J., 1888, C. E. Dayton, Ohio.	Assistant City Engineer.
Chaffin, W. W., 1904, C. E. Columbus, Ohio.	Assistant on Engineer Corps, Indianapolis Div. Pa. Lines.
Chambers, Wm. R., 1904, M. E. Lynn, Mass.	In Testing Dept., General Electric Co.
Chappell, Walter E., 1898, E. E. Trafford Pk., Manchester, Eng.	With the British Westinghouse Electric Co., Ltd.
Chubb, C. St. J., Jr., 1904, C. E. (Arch.) Columbus, Ohio.	Asst. Professor of Architecture, O. S. U.
Chubb, Joseph H., 1904, C. E. Columbus, Ohio.	
Chubb, L. W., 1905, E. E. East Pittsburg, Pa.	With Westinghouse E. & M. Co.
Chubb, W. Morris, 1907, C. E. Meeker, Colorado.	U. S. Examiner of Surveys.
Cilley, Raymond, 1896, M. E. Brooklyn, N. Y.	Draftsman, Graham Fox Motor Co.
Clark, Thomas W., 1904, E. M., (Cer.) Roseville, Ohio.	With the Ohio Pressed Brick Co.
Clarke, C. J., 1899, C. E. Columbus, Ohio.	Draftsman, City Engineer's Office.
Clarke, James U., 1902, E. E. Lancaster, Ohio.	Supt. Lancaster Traction & Power Co.
Cobb, Norval H., 1907, B. Sc. (Ind. A.). Warren, Ohio.	With Peerless Transformer Co.
Coddington, E. F., 1896, C. E., 1897, M. Sc.; 1902, Ph. D. (Berlin.). Columbus, Ohio.	Asst. Professor of Mechanics, Ohio State University.
Coe, Elmer R., 1906, E. E. 706 Coal St., Wilkinsburg, Pa.	Asst. to Electrical Engineer, Union Switch and Signal Co.
Cole, George N., 1891, E. E. 277 Broadway, N. Y. City.	Mfg. Cross, Horizontal, Folding and other Warehouse Doors.
Collins, Curtis, 1895, E. E. Columbus, Ohio.	Asst. Supt. of Columbus Railway and Light Co.
Conley, Clyde G., 1902, C. E. Mt. Vernon, Ohio.	Draftsman, Mt. Vernon Bridge Co.
Connell, Wm. A., 1886, E. M. Kansas City, Mo.	
Conrad, Herman W., 1905, M. E. Milwaukee, Wis.	Special Apprentice, with Allis-Chalmers Co.
Conrad, Louis Verne, 1902, C. E. Pittsburg, Pa.	Asst. on Engineers' Corps, P., C., C. & St. L. R. R.

Conway, Hugh L., 1896, C. E. Cincinnati, Ohio.	Assistant City Engineer.
Cook, Spencer N., 1903, E. M. Des Moines, Iowa.	Supt., Smith-Lowe Coal Co.
Cooper, Charles P., 1907, E. E. Durham, N. H.	Instructor in Elec. Eng., N. H. Col. of Agr. and Mech. Arts.
Cooper, S. D., 1905, E. E. Cleveland, Ohio.	With Brown Hoist Co.
Cope, Albert N., 1897, E. E. Columbus, Ohio.	Chief Electrician, Columbus Public Service Co.
Cosley, Harvey H., 1901, C. E. Chicago, Ill.	Salesman, Cambria Steel Co.
Coulter, Leonard B., 1904, E. M. (Cer.) Columbus, Ohio.	With Prof. Edward Orton, Jr., Clay Testing and Mfg. Clay Specialties.
Covell, Vernon R., 1895, C. E. Pittsburg, Pa.	Deputy County Engineer, Allegheny Co.
Cowles, Howard E., 1907, C. E. Bastrop, La.	Civil Engineer.
Crabbs, Jay Mitchell, 1907, C. E. Painesville, Ohio.	Civil Engineer.
Crable, Arthur, 1901, C. E. Huntington, Ind.	Division Engineer, Chicago & Erie Ry. Co.
Craft, F. M., 1905, E. E. Chicago, Ill.	Telephone Engineer, Western Electric Co.
Cranston, Harry D., 1907, E. E. Cincinnati, Ohio.	Erecting Foreman, General Electric Co.
Crocker, T. D., 1904, E. E. Milwaukee, Wis.	With Electric Ry. & Light Co.
Crooks, Thomas E., 1904, M. E. Lynn, Mass.	In Testing Dept., General Electric Co.
Croy, Harold L., 1906, M. E. Dayton, Ohio.	Inventions Dept., Nat. Cash Register Co.
Cunningham, E. W., 1894, C. E. Ambridge, Pa.	With American Bridge Co.
Cunningham, R. H., 1905, M. E. Cleveland, Ohio.	Salesman for The Ingersoll-Rand Co.
Curran, Michael F., 1905, C. E. New Orleans, La.	Asst. on Eng. Corps, Illinois Central R. R.
Curtis, Leigh G., 1899, C. E. Chicago, Ill.	Asst. Supt., B. & O. R. R.

D

Damron, Carson W., 1897, M. E. Pittsburg, Pa.	Asst. Engineer, Bollinger Andrews Construction Co.
Dann, Walter M., 1902, E. E. East Pittsburg, Pa.	With Westinghouse Electric & Manufacturing Co.
Davis, Charles W., 1894, E. M. Cleveland, Ohio.	Investments.
Davis, Franklin L., 1907, E. M. Las Esperanzas, Coah., Mex.	Mining Engineer, with Mexican Coal and Coke Co.

Davis, Oscar Allen, 1897, E. E. Alliance, Ohio.	Mechanical Engineer, Reeves Bros. Co.
Deahl, Walter S., 1896, C. E. Pittsburg, Pa.	Draftsman, Pittsburg Bridge Co.
Dean, Walter O., 1907, E. E. Lima, Ohio.	Electrician, with Reed Bros. Elec. Co.
DeLoffre, Andre, 1896, E. E. London, E. C., England.	Electrical Engineer for General Electric Co. of America.
Demorest, Dana James, 1907, B. Sc. (Chem.) Omaha, Neb.	Chemist, Laboratory Southern Pacific Ry.
Denny, Chas. W., 1901, E. E. 220 W. 29th, New York, N. Y.	In Experimental Dept., Cooper Hewitt Electric Co.
DeWolf, R. D., 1901, E. E. Pittsburg, Pa.	Electric Engineer, Westinghouse Elec. & Mfg. Co.
Diemer, Hugo, 1896, E. E. Indianapolis, Ind.	Consulting Engineer.
Dill, Raymond, 1901, E. E. Norwood, Ohio.	Sales Dept., Bullock Works, Allis-Chalmers Co.
Donham, M. D., 1896, M. E. Pittsburg, Ohio.	Supt. of Agents, Nat. Life Ins. Co. of Vermont.
Dorsey, Walter A., 1904, M. E. Lynn, Mass.	In Testing Dept., General Electric Co.
Doty, Oliver P., Jr., 1904, M. E. Hanging Rock, Ohio.	Engineer.
Drackett, Harry R., 1907, B. Sc. (Chem.) Ivorydale, Ohio.	Foreman, Soap Powder Dept., Proctor & Gamble.
Drummond, Wm. G., 1900, M. E. Chicago, Ill.	Mechanical Engineer.
Dun, John J., 1883, E. M. Columbus, Ohio.	Consulting Engineer.
Dunlap, Robert R., 1900, E. E. Columbus, Ohio.	Electrical Engineer, Jeffrey Manufacturing Co.
Dunlap, T. C., 1895, E. E. Columbus, Ohio.	Vice-Pres. and Manager Columbus Pneumatic Tool Co.
Dunnick, Edward, 1897, C. E. Cincinnati, Ohio.	With Brackett Bridge Co.
Dupuy, B. F., 1904, C. E. Clio, Cal.	Draftsman, Western Pacific Railway.
Dupuy, Victor N., 1907, C. E. Long Beach, Cal.	Civil Engineer.
Durbin, William H., 1906, C. E. Sandusky, Ohio.	In City Engineer's Office.
Dyche, Howard E., 1906, E. E. Cincinnati, Ohio.	Apprentice, Allis-Chalmers Co.

E

Eagle, William H., 1906, C. E. Columbus, Ohio.	In City Engineer's Office.
Embrey, Morrow L., 1906, M. E. Milwaukee, Wis.	With Allis-Chalmers Co.

Emswiler, John E., 1903, M. E. Schenectady, N. Y.	In Turbine Testing Dept., General Electric Co.
Erskine, James H., 1886, E. M., M. D. Albany, Ore.	Physician and Surgeon.
Estep, Frank L., 1898, E. E. Detroit, Mich.	Second Asst. Supt., Detroit Copper and Brass Rolling Mills.
Evans, Peter P., 1892, C. E. Osborn Bldg., Cleveland, Ohio.	Contracting Engineer.
Eysenbach, E. E., 1896, E. M. Binghamton, N. Y.	Gen'l Mgr., Binghamton Gas Co.

F

Fackt, George P., 1907, E. M. (Cer.) Mascoutah, Ill.	Ceramic Eng., with St. Louis Terra Cotta Co.
Feight, Edward R., 1904, M. E. Wilkinsburg, Pa.	Turbine Dept., Westinghouse Machine Co.
Feight, Russell S., 1890, E. E. Pittsburg, Pa.	Head of Industrial Division, Engineering Dept., Westinghouse Elec. & Mfg. Co.
Felger, Theodore H., 1906, M. E. Milwaukee, Wis.	With Allis-Chalmers Co.
Fergus, Guy C., 1898, E. E. Zanesville, Ohio.	Partner, Zanesville Electric Co.
Ferguson, James W., 1907, M. E. Columbus, Ohio.	With Kilbourne & Jacobs Co.
Fickes, Walter M., 1900, E. M. Carnegie, Pa.	Brick Manufacturer.
Fieldner, Arno C., 1906, B. Sc. (Chem.) 185 W. 9th Ave., St. Louis, Mo.	With U. S. Geological Survey.
Fish, Fred. Alan, 1898, E. E. Ames, Iowa.	Associate Professor of Electrical Engineering, Iowa State College.
Fisher, Charles S., 1907, M. E. Columbus, Ohio.	Assistant in Mechanical Engineering, O. S. U.
Floto, Julius, 1889, E. M. Chicago, Ill.	Agent, Brown-Keetcham Iron Works of Indianapolis.
Flower, Arthur H., 1907, B. Sc. (Chem.) Omaha, Neb.	Chemist.
Flowers, Dean W., 1905, E. M. Bennington, N. Y.	With the Bennington Gas Co.
Flynn, Harry F., 1892, C. E. Manila, P. I.	Chief Surveyor, Bureau of Public Lands.
Ford, Nile Otis, E. M., 1897, A. B.; 1900, M. S. San Francisco, Cal.	Asst. Manager, Herring-Hall-Marvin Safe Co.
Forester, Charles T., 1906, M. E. Denver, Colo.	With Denver Gas & Electric Co.

Fortney, Carlton E., 1907, E. M. Barroteran, Coah., Mex.	Mining Engineer.
Foster, Frank M., 1894, E. E. Cincinnati, Ohio.	Secy. and Treas., American Valve and Meter Co.
Foster, Vause, 1903, E. M. Chillicothe, Ohio.	Deputy Co. Surveyor.
Fowler, Harry R., 1894, E. E. Toledo, Ohio.	Electrical Engineer and Contractor.
Fox, Arthur L., 1906, M. E. New York City.	With New York Telephone Co.
Fox, John Herbert, 1897, M. E. Cleveland, Ohio.	Consulting Engineer.
Frame, Rollo S., 1901, C. E. Pittsburg, Pa.	Asst. on Engineer Corps, Penna. Lines.
Frankenberg, G. T., 1902, M. E. Columbus, Ohio.	Mechanical Engineer, The Ralston Steel Car Co.
Frankenberg, J. T., 1899, E. E. Providence, R. I.	Chief Engineer, Providence Telephone Co.
Fravel, George B., 1888, M. E. Chicago, Ill.	Master Mechanic, Chicago Terminal Division, Penna. Lines.
Frayer, Lee A., 1896, M. E. Columbus, Ohio.	With Columbus Machine Co.
Frechtling, Arthur, 1901, M. E. Beloit, Wis.	With Fairbanks-Morse Co.
Freeman, S. S., 1898, E. M. Parrysville, Pa.	Blast Furnace Manager, Carbon Iron & Steel Co.
French, Thomas E., 1895, M. E. Columbus, Ohio.	Professor of Engineering Drawing, O. S. U.
Frost, George W., 1900, M. E. Dayton, Ohio.	With the Dayton Electric Co.
Fuller, Charles W., 1904, E. M. Copper Mountain, Alaska.	Metallurgist.

G

Galleher, Chester P., 1907, E. E. McKeesport, Pa.	With C. D. & P. Tel. Co.
Gallen, William F., 1897, M. E. Columbus, Ohio.	Foreman of Drafting Room, Case Manufacturing Co.
Gamper, Herman, 1899, M. E. Xenia, Ohio.	Supt. Engineering Dept., O. S. & S. O. Home.
Garber, John M., 1897, C. E. Wheeling, W. Va.	Chief Draftsman, W. Va. Bridge & Construction Co.
Gard, Irving R., 1907, E. M. Columbus, Ohio.	With Jeffrey Mfg. Co.
Gault, Paul M., 1906, E. E. 116 New York St., Pittsburg, Pa.	Signal Dept., Penna. Ry.
Gee, Eugene C., 1897, E. E. Manila, P. I.	Gen. Manager, Philippine Island Tel. & Tel. Co.
Gehres, Hewitt A., 1907, M. E. Gary, Ind.	With Indiana Steel Co.
Gehrkens, E. F., 1894, E. E. Schenectady, N. Y.	With General Electric Co.

Gerwick, Benjamin C., 1906, C.E. Clairville, Plumas Co., Cal.	With Western Pacific R. R.
Gibson, John C., 1906, E. M. Las Esperanzas, Coah., Mexico.	Mine Engineer.
Given, James Byron, 1896, E. E. Chicago, Ill.	In Telephone Dept., Western Electric Co.
Glass, Robert G., 1906, C. E. Wheeling, W. Va.	With B. & O. R. R.
Glunt, Omer M., 1906, E. E. 593 W. Monroe St., Chicago, Ill.	With Telephone Dept., Western Electric Co.
Goddard, Loring H., 1892, C. E. Wooster, Ohio.	Farmer.
Goodell, Ralph S., 1892, C. E. Mt. Vernon, Ohio.	Principal Assistant Engineer, Mt. Vernon Bridge Co.
Gotschall, James L., 1907, C. E. Mt. Vernon, Ohio.	Bridge Drafting.
Gould, Wm. S., 1904, M. E. Lynn, Mass.	In Steam Turbine Testing Dept., Gen. Electric Co.
Graham, Emery E., 1898, E. E. Cleveland, Ohio.	Draftsman, Wellman-Seaver-Morgan Engineering Co.
Graham, John W., 1907, C. E. Ambridge, Pa.	Draftsman, American Bridge Co.
Grate, Charles A., 1898, M. E. Cleveland, Ohio.	With Interstate Engineering Co.
Green, Jerome J., 1892, E. E. Notre Dame, Ind.	Professor of Physics and Electrical Engineering, University of Notre Dame.
Green, Joseph F., 1890, E. E. Moline, Ill.	Electrical Engineer, Moline Elec. Elev. Co.
Gregory, Hiram D., 1880, E. M. Covington, Ky.	Attorney-at-Law.
Griffin, Mark H., 1897, E. E. Spitzer Bldg., Toledo, Ohio.	Real Estate Agent.
Groves, John W., 1898, C. E. Carbon, W. Va.	Supt. Republic Coal Co.
Guiss, Charles A., 1905, C. E. Bucyrus, Ohio.	City Engineer.
Gwynne, Josiah W., 1904, E. E. Montreal, Can.	Sales Dept., Canadian Westinghouse Co.

H

Haas, Frank, 1895, C. E.; 1896, E. M. Fairmount, W. Va.	Chemist, Fairmount Coal Co.
Hackney, W. W., 1905, M. E. Fort Wayne, Ind.	With Western Car Construction Co.
Hagemeyer, Earl P., 1905, C. E. Cincinnati, Ohio.	Asst. to Supt., Baldwin Piano Co.
Hale, Frederick J., 1898, M. E.; 1900, M. Sc. East Pittsburg, Pa.	Asst. Foreman, Westinghouse Machine Co., Gas Engine Dept.

Hall, Charles R., 1906, M. E. Columbus, Ohio.	With Columbus Structural Steel Co.
Hall, Harry R., 1889, E. M. Sault Ste. Marie, Ont., Can.	Supt. Blast Furnace, The Lake Superior Power Co.
Hall, Rolla W., 1907, E. E. Schenectady, N. Y.	In Testing Dept., G. E. Co.
Hallstead, Robert H., 1906, C. E. Denver, Col.	
Halsema, Eusebius J., 1907, C. E. Los Angeles, Cal.	Kistler & Halsema, Civil Engineers.
Hamilton, Ross E., 1903, C. E. Coshocton, Ohio.	
Hammond, C. E., 1905, E. E. 4731 S. Atlanta St., Pittsburg, Pa.	With National Tube Co.
Hammond, John M., 1902, C. E. Dunkirk, N. Y.	Assistant in Eng. Dept., L. S. & M. S. Ry.
Hance, Harry T., 1901, B. Sc. (Chem.) Columbus, Ohio.	Sec.-Treas. of Hance Casting Co.
Hange, Frederick I., 1906, E. E. Chicago, Ill.	With Western Electric Co.
Hapgood, Eugene P., 1902, B. Sc. Salt Lake City, Utah.	Assistant, Maintenance of Way Dept., S. P. L. A. & S. L. R. R.
Haring, James Y., 1907, E. E. Syracuse, N. Y.	Eng., with Syracuse Lighting Co.
Hardy, Paul, 1904, E. M. Holden, W. Va.	Supt., U. S. Coal & Oil Co.
Harkins, Robert R., 1900, M. E. Pittsburg, Pa.	Manager Pittsburg Office, Atlas Engine Co.
Harrington, A. L., 1905, E. E. Pittsburg, Pa.	With General Electric Co.
Harrison, Wm. H., 1885, C. E. Columbus, Ohio.	Railway Engineer.
Harrod, Otis W., 1907, E. E. Perrysville, Ohio.	
Harrop, Carl B., 1902, E. M. Columbus, Ohio.	Secretary, Scott Kiln Drying Co.
Harsh, Harry H., 1907, C. E. Parkersburg, W. Va.	Asst. on Eng. Corps, B. & O. Ry.
Hartwell, Arthur, 1888, M. E. Detroit, Mich.	Manufacturer.
Hartwick, Louis M., 1897, M. E. Pueblo, Col.	Master Mechanic, Blast Furnace, C. F. & I. Co.
Harvey, Clarke K., 1906, C. E. 602 Times Bldg., Pittsburg, Pa.	Civil Engineer.
Hassler, Robert H., 1892, E. E. Indianapolis, Ind.	Engineer, International Motor Car Co.
Hawkins, Ned E., 1907, C. E. Medina, Ohio.	Civil Engineer.
Hawthorne, Carl H., 1905, C. E. Kansas City, Mo.	In Railroad Engineering Work.

Hayman, Wm. C., 1906, E. E. Schenectady, N. Y.	Engineer, Wire & Cable Dept., General Electric Co.
Hayward, George E., 1893, C. E. Bronson, Mich.	Sec.-Treas., American Truss Post Co.
Hazlett, Robert, 1887, C. E. Wheeling, W. Va.	Consulting Civil Engineer.
Hebble, Charles R., 1896, E. E. Cincinnati, Ohio.	Gen'l Sales Mgr., The World Mfg. Co.
Hecker, Ralph E., 1907, E. E. Schenectady, N. Y.	Apprentice in Testing Dept., Gen. Elec. Co.
Helvey, George S., 1903, M. E. Milwaukee, Wis.	With Allis-Chalmers Co.
Henderson, A. A., 1898, C. E. Pittsburg, Pa.	Civil Engineer.
Henrietta, Chas. M., 1896, E. M. Calgary, N. W. Territory, Can.	In Mining and Metallurgical Dept., Canadian Pac. R. R.
Hepner, C. R., 1905, E. E. Cleveland, Ohio.	With Lincoln Electric Co.
Hertner, John H., 1899, E. E. Cleveland, Ohio.	Of Hertner Electric Co.
Hewitt, S. R., 1898, E. E. Columbus, Ohio.	With Kinnear Mfg. Co.
Hill, Cortland L., 1903, C. E. Beckley, W. Va.	Railroad Engineering.
Hills, Frederick A., 1907, E. E. Portland, Oregon.	With The Portland Eng. Co.
Hine, Lucius A., 1888, E. M. Chicago, Ill.	Pres. and Treas., Hine-Watt Manufacturing Co.
Hinkle, Albert H., 1907, C. E. Greenville, Ohio.	Deputy Co. Surveyor.
Hipple, John M., 1893, E. E. Pittsburg, Pa.	Engineer, Westinghouse Electric & Mfg. Co.
Hirsch, Gustav, 1897, E. E. Lima, Ohio.	Chief Engineer and Vice-President, Ideal Construction Co.
Hirst, Harry, 1903, E. M. Dennison, Ohio.	Supt., Dennison Mining Co.
Hitch, James F., 1902, C. E. Williamson, W. Va.	Engineer, Ohio & Big Sandy Coal Co.
Hite, Florence E., 1904, C. E. Torreon, Mex.	Architectural Draftsman.
Hobbs, Caleb, 1905, E. E. Schenectady, N. Y.	Foreman of Government Electric Test, with General Electric Co.
Hock, John A., 1907, M. E. Columbus, Ohio.	Special Apprentice, Hocking Valley Ry.
Holbrook, George F., 1902, E. M. Hollywood, Cal.	Surveyor, with City Engineer.
Holl, Alfred T., 1906, C. E. 703 N. Clarendon Ave., Canton, Ohio.	With J. H. Holl, McKinley National Memorial.
Holloway, T. W., 1904, M. E. Scranton, Pa.	With International Correspondence Schools.

Homan, Frank, 1895, C. E...... Carbon, W. Va.	Supt. Republic Coal Co.
Hood, Willard J., 1904, M. E.... Huntington, W. Va.	In Motive Power Dept., C. & O. R. R.
Hope, H. L., 1905, E. E......... Chicago, Ill.	Telephone Engineering.
Hopkins, Lloyd C., 1905, M. E.. St. Louis, Mo.	Chemist, with U. S. Geological Survey, Fuel Testing Plant.
Howald, Ferd., 1878, B. Sc.; 1881, E. M. Columbus, Ohio.	Coal Operator.
Howard, Howard R., 1906, E. M.	
Howe, Roy E., 1904, C. E....... Roosevelt, Idaho.	Assayer.
Howells, E. S., 1884, E. M...... Birmingham, Ala.	President, Howells Mining Co.
Howells, T. J., 1897, E. M....... Bluefield, W. Va.	Chemist, in Pocahontas Coal Field for National Steel Co.
Huddleson, F. N., 1902, E. M.... Salt Lake City, Utah.	In Maintenance of Way Dept., S. P., L. A. & S. L. Ry.
Hull, Walter A., 1902, E. M.... (Cer.) Drummond, Pa.	General Manager, Shawmut Clay Mfg. Co.
Hultquist, Victor J., 1907, M. E. Schenectady, N. Y.	With American Locomotive Co.
Humphrey, H. P., 1904, E. M... (Cer.) Bradford, Pa.	Vice President Northeastern Terra Cotta Co.
Hunt, Wm. F., 1887, M. E.; 1895, LL. B.; 1896, LL. M. (Univ. of Minn.) St. Paul, Minn.	Attorney-at-Law.
Hunter, James W., 1904, C. E... Evansville, Ill.	Division Engr., Evansville & Terre Haute R. R.
Hunter, Madone C., 1900, E. E.. St. Joseph, Mo.	Consulting Engineer.
Huntington, A., 1899, M. E..... Sioux Falls, S. Dak.	President of Cascade Milling Co.
Hurlburt, Charles C., 1906, C.E. Columbus, Ohio.	Engineering Corps, H. V. Ry.
Hyle, Charles A., 1896, E. E.... Yellowstone Park, Wyo.	Observer, U. S. Weather Bureau.

I

Iancu, Joseph, 1905, E. E....... Schenectady, N. Y.	With General Electric Co.
Ireland, Guy L., 1895, M. E.....	
Irvin, Chadwick H., 1897, M. E.. Great Falls, Mont.	With Boston and Montana Smelter.

J

JACOBI, JACOB A., 1905, C. E......	Asst. on Eng. Corps, Illinois Central R. R.
JAYNES, GAYLOR C., 1906, E. M... Leopold, New Mexico.	Chief Engineer, Burr Mountain Copper Co.
JEANNOT, FREDERICK C., 1905,M.E. Cleveland, Ohio.	With Osborn Engineering Co.
JENKINS, WILLIAM G., 1893, C. E. Bellefontaine, Ohio.	Draftsman, The Bellefontaine Bridge & Iron Co.
JENKINS, WILLIS H., 1894, C. E.. Sheridanville, Pa.	Transitman, Penn. Lines West of Pittsburg.
JENNINGS, LEVI E., 1897, E. E... Dayton, Ohio.	With R. E. Kline, Consulting Engineer.
JOHNSON, CHAS. W., 1896, E. E... Montreal, Can.	General Superintendent Allis-Chalmers Bullock Co., Ltd.
JOHNSON, EARL S., 1900, E. E.... Schenectady, N. Y.	In Testing Dept., General Electric Co.
JOHNSON, WALTER A., 1902, M. E. Ft. Wayne, Ind.	Foreman Motive Power Dept., Penna. Lines.
JOHNSTON, GEORGE E., 1892, C. E.. Louisville, Ky.	Roadmaster and Assistant Engineer, L. & N. R. R.
JOHNSTON, H. L., 1892, E. E...... Troy, Ohio.	Manager Hobart Electric Mfg. Co.
JONES, ARTHUR J., 1898, E. E.... Niagara Falls, N. Y.	Foreman, with Niagara Falls Power Co.
JONES, GRANDVILLE R., 1904, C. E. Washington, D. C.	Asst. Civil Eng., Bureau of Water Supply.
JONES, HOUSTON, 1895, E. E...... 604 Burlington Bldg., St. Louis, Mo.	Consulting Engineer.
JONES, PEARL N., 1892, E. E...... Wilkinsburg, Pa.	Chief Engineer, Pittsburg Ry. Co.
JONES, SMILEY, 1894, E. M....... Prescott, Arizona.	
JUDD, HORACE, 1897, M. E.; 1899, M. Sc. Columbus, Ohio.	Assistant Professor in Experimental Engineering, O. S. U.
JUDSON, WALTER R., 1903, M. E.. Mapini, Durango, Mexico.	With Compania Minera de Penoles.

K

KALB, WARREN C., 1904, E. E.... Columbus, Ohio.	Mechanical Engineering, Columbus Pneumatic Tool Co.
KANMACHER, S. H., 1900, E. E... Schenectady, N. Y.	Engineer, Power and Mining Eng. Dept., Gen. Elec. Co.
KEATING, H. T., 1902, B. Sc..... (Chem.) Columbus, Ohio.	Insurance.
KEFFER, FREDERICK, 1892, E. M... Greenwood, British Col.	General Manager, The British Columbia Copper Co., Ltd.

Keilholtz, Lester S., 1907, M. E. Beloit, Wis.	Special Apprentice, Fairbanks-Morse Mfg. Co.
Kemmler, E. A., 1888, C. E. Columbus, Ohio.	Second Assistant City Engineer.
Kempton, W. H., 1905, E. E. East Pittsburg, Pa.	With Westinghouse Eng. & Mfg. Co.
Kern, William F., 1902, B. Sc. (Chem.) Manhattan, Nev.	Chemist and Mining Engineer.
Kerr, Samuel T., 1894, E. E. Martins Ferry, Ohio.	Supt., Municipal Electric Light Plant.
Kester, Frederick E., 1895, E. E.; 1905, Ph. D. (Cornell). Columbus, Ohio.	Assistant Professor of Physics, O. S. U.
Kettering, Chas. F., 1904, E. E. Dayton, Ohio.	Chief of Electrical Invention Dept., National Cash Register Co.
Kettler, Frank C., 1901, C. E. Chicago, Ill.	In North Works, Illinois Steel Co.
Kiesewetter, L. F., 1891, C. E.; 1892, A. B., and 1893, A. M. (Harv.) Columbus, Ohio.	Cashier, The Ohio National Bank.
Kilmer, Arthur D., 1907, C. E. Columbus, Ohio.	Asst. on Eng. Corps, Penna. Lines.
King, Herbert S., 1901, C. E. Springfield, W. Va.	Eng. of Construction, Springfield Colliery Co.
King, Roy S., 1892, M. E. Columbus, Ohio.	Assistant Professor of Experimental Engineering, O. S. U.
Kirker, John W., 1907, M. E. Worthington, Ohio.	
Kissell, John E., 1907, C. E. Springfield, Ohio.	With Eng. Corps, Big Four Ry.
Kistler, Homer K., 1907, C. E. Los Angeles, Cal.	Civil Engineer.
Klie, Walter, 1903, M. E. Columbus, Ohio.	With Klie Plumbing Co.
Kline, Charles H., 1897, E. E. Dayton, Ohio.	Civil Engineering, with R. E. Kline, Consulting Engineer.
Knecht, Arthur E., 1898, M. E. Cincinnati, Ohio.	Mechanical Engineer, Cincinnati Screw and Tap Co.
Knight, Wm. Abner, 1900, M. E. Columbus, Ohio.	Assistant Professor of Machine Shop Practice, O. S. U.
Knisely, Jesse C., 1907, C. E. New Philadelphia, Ohio.	County Surveyor.
Knopf, C. S., 1905, E. E. Columbus, Ohio.	Machinist, Elec. Eng. Dept., O. S. U.
Knox, Frank S., Jr., 1900, E. M. Buchtel, Ohio.	Chief Engineer, Pittsburg Coal Co.
Koeper, Landry L., 1907, C. E. Aberdeen, Wash.	With Eng. Corps, Northern Pacific Ry.

Krumm, Louis R., 1898, E. E.... Columbus, Ohio.	Electrical Engineer, War Dept.
Krumm, Thomas Z., 1902, C. E.. Mandan, N. D.	Surveyor, with Northern Pacific R. R.
Kryder, Ernest R., 1906, C. E... Logansport, Ind.	Civil Engineer.
Kuenzel, Oscar, 1905, M. E..... Columbus, Ohio.	With Motive Power Dept., Penna. Lines.
Kuhn, Vallie H., 1896, E. E.... Etna, Ohio.	Machinist.
Kunkle, Fred. R., 1903, E. E.... Pittsburg, Pa.	Electrical Engineer, Westinghouse Elec. & Mfg. Co.

L

Lake, Lewis J., 1905............ Mt. Vernon, Ohio.	With Mt. Vernon Bridge Co.
Lamb, Whitney E., 1900, E. E... Commercial Pt., Ohio.	Farmer and Stockman.
Lamme, Benjamin G., 1888, M.E. Pittsburg, Pa.	Chief Engineer, Westinghouse Elec. & Mfg. Co.
Lamme, Bertha A. (Mrs. R. S. Feicht), 1893, E. E. 1115 Portland St., Pittsburg, Pa.	
Landahl, Eugene E., 1905, E. M. Columbus, Ohio.	With The Jeffrey Mfg. Co.
Large, Joseph H., 1890, C. E..... Toledo, Ohio.	Draftsman, Massillon Bridge Co.
Larzelere, Wm. E., 1907, E. E.. Pittsburg, Pa.	Student Apprentice, W. E. & M. Co.
Laurencena, Miguel J., 1906, E. E. Parana, Argentine, Rep.	Electrical Engineer.
Laylin, David T., 1905, M. E.... Hawthorne, Ill.	With Western Electric Co.
Layman, Frank E., 1905, E. M.. (Cer.) Saylorsburg, Pa.	With Blue Ridge Enamel Brick Co.
Lee, Corliss Edgar, 1900, E. E... Schenectady, N. Y.	With General Electric Co.
Lee, Louis R., 1906, E. E........ 61 W. 3d Ave., Columbus, Ohio.	Assistant to M. S. Hopkins.
Lee, Robert M., 1897, M. E...... Washington, D. C.	Draftsman, Ordnance Dept., U. S. Army.
Leeper, Ralph W., 1907, M. E... Schenectady, N. Y.	In Turbine Dept., General Electric Co.
Leibold, Carl P., 1904, E. E...... Mansfield, Ohio.	With Ohio Brass Co.
Lesh, John Howard, 1901, M. E. Bedford, Ohio.	Chief Draftsman, Interstate Engineering Co.
Levering, O. D., 1893, M. E...... Columbus, Ohio.	Manufacturer Wall Ties.

Lincoln, Paul M., 1892, E. E.... Pittsburg, Pa.	Head of Power Div., Engineering Dept., Westinghouse Elec. & Mfg. Co.
Linebaugh, Jesse J., 1899, E. E.. Schenectady, N. Y.	Electrical Engineer, Railway Engineering Dept., General Electric Co.
Linville, C. P., 1900, B. Sc...... (Chem.) 1902, A. M. State College, Pa.	Instructor in Metallurgy, Pennsylvania State College.
Logan, L. L., 1896, E. M......... Robertsdale, Pa.	General Supt., Rockhill Iron & Coal Co.
Long, George G., 1903, E. M..... Gary, McDowell Co., W. Va.	With Engineering Dept., U. S. Coal & Coke Co.
Lott, Charles M., 1895, E. E.... Hicksville, Ohio.	Prop. and Supt. of Hicksville Electric Light Plant.
Lovejoy, Ellis, 1885, E. E....... Columbus, Ohio.	Consulting Engineer.
Lowrie, Cassius R., 1907, M. E.. Columbus, Ohio.	Draftsman, Kilbourne & Jacobs Mfg. Co.
Lucas, Harry N., 1906, E. E..... 926 South Ave., Wilkinsburg, Pa.	With W. E. & M. Co.
Lyon, Arthur H., 1900, M. E.... Bucyrus, Ohio.	Works Manager, New York Blower Co.

M

McAllen, Wm. J., 1894, C. E.... Chicago, Ill.	Civil Engineer, Structural Department, North Works, Illinois Steel Co.
McCarter, R. D., Jr., 1895, E. E.. London, E. C., England.	Manager and Engineer, Bath Electric Tramway, Ltd.
McCormick, J. H., 1880, M. E... 1354 Fair Ave., Columbus, Ohio.	Mechanical Engineer.
McCormick, W. F., 1896, M. E... Chicago, Ill.	With Illinois Steel Co.
McFadden, John H., 1907, C. E.. St. Louis, Mo.	With Eng. Corps, Missouri Pacific Ry.
McFarland, H. M., 1902, E. M... Ensley, Ala.	Division Engineer.
McGarey, Leo S., 1904, E. E..... Columbus, Ohio.	With Scioto Valley Traction Co.
McGarraugh, Robert S., 1906... Columbus, Ohio.	
McGrew, John A., 1895, C. E.... Columbus, Ohio.	President Nat. Eng. Co.
McGuffey, F. H., 1894, E. E..... Conover, Ohio.	Clerk in Railway Mail Service.
McIntire, Alfred H., 1898, E. E.; 1900, M. E. Pittsburg, Pa.	Editor, The Electric Journal.
McIntosh, Roscoe E., 1902, E. E. Los Angeles, Cal.	Electric Engineer, with McIntosh Elec. Co.

McKeon, Robert D., 1902, C. E.. Logansport, Ind.	Assistant on Engineers' Corps, Logansport Div., P., C., C. & St. L. Ry.
McMaster, Carlos L., 1905, C. E. Champaign, Ill.	Instructor in Drawing, Univ. of Illinois.
McNary, G. B., Jr., 1896, E. E... Toledo, Ohio.	Purchasing Agent, F. Bissell Co.
Manley, Rush E., 1894, E. E.... Columbus, Ohio.	Chief Inspector, Central Union Telephone Co.
Marckworth, O. S., 1901, B. Sc.. (Chem.) Columbus, Ohio.	Analytical and Consulting Chemist.
Marker, James R., 1904, C. E... Greenville, Ohio.	County Surveyor, Darke Co.
Marquardt, Frank F., 1896, C. E. Sharon, Pa.	Supt., The Sharon Coke Co.
Marquardt, Wm. B., 1905, E. M.. Sharon, Pa.	Supt., F. H. Buhl Club.
Marshall, Chas. H., 1903, M. E. Fort Wayne, Ind.	With Western Gas Construction Co.
Marshall, W. B., 1900, E. E....	
Martin, George, 1897, E. E...... Elyria, Ohio.	Foreman Drafting, Electrical Dept., National Tube Co.
Martin, John D., 1901, M. E.... New Straitsville, Ohio.	Coal Operator.
Martin, Percy, 1892, E. E....... Coventry, England.	General Manager, Daimler Motor Co.
Martin, Ray M., 1904, M. E..... Inglis, Fla.	Chief Engineer, Barker Chemical Co.
Marvin, Charles F., 1883, M. E. Washington, D. C.	Professor of Meteorology, in Charge Instrument Division, U. S. Weather Bureau.
Masjoan, Juan, 1906, E. E...... Parana, Argentine Rep.	Electrical Engineer.
Masters, George A., 1886, C. E.. Topeka, Kas.	Assistant Bridge Engineer, A. T. & S. F. Ry. System.
Maurer, Oscar V., 1906, E. E... 1824 79th St., N. E. Cleveland, Ohio.	With Cuyahoga Incandescent Lamp Co.
Meiklejohn, Robert, 1904, M. E. Columbus, Ohio.	Instructor in Engineering Drawing, O. S. U.
Melick, Cyrus A., 1903, C. E..... Schenectady, N. Y.	Instructor in Civil Eng., Union College.
Melick, Neal A., 1900, C. E..... 232 Raleigh Ave., Norfolk, W. Va.	Asst. Eng., Tidewater R. R.
Mellinger, A. H., 1905, E. E.... New York City.	With New York Telephone Co.
Menough, A. G., 1894, E. M..... Wellsville, Ohio.	Secy. and Treas., Menough Iron & Steel Fdry. Co.
Mercer, Frank E., 1896, E. M... San Francisco, Cal.	With Risdon Iron and Locomotive Works.
Mercer, Robert W., 1903, E. M... Gary, McDowell Co., W. Va.	Computer, U. S. Coal & Coke Co.

Merrill, Ernest M., 1902, C. E. Beckley, W. Va.	General Engineering.
Merrill, Ferrand S., 1905, C. E. Toledo, Ohio.	Draftsman, American Bridge Co.
Merrill, Ralph O., 1906, E. E. 4122 Chester Ave., Philadelphia, Pa.	Inspector, Bell Telephone Co.
Mershon, Ralph D., 1890, M. E. 11 Pine St., New York City.	Consulting Engineer.
Metz, Ora F., 1905, E. E. Cincinnati, Ohio.	Asst. Foreman Testing Dept., Bullock Electric Co.
Miller, Albert A., 1902, C. E. Philadelphia, Pa.	Division Engineer, B. & O. R. R.
Miller, Carl D., 1907, E. E. Santa Cruz de Alaya Sinalva, Mex.	
Miller, Frank Case, 1893, C. E. Sacramento, Cal.	Division Engineer, Sacramento Div., Southern Pacific Ry.
Miller, Henry F., 1889, M. E. 345 E. State St., Columbus, Ohio.	Consulting Engineer.
Miller, Ralph C., 1901, C. E. Logansport, Ind.	Asst. Eng., M. of W., Penna. Lines.
Milne, Morgan C., 1907, E. M. Elk Lake, Latchford, Ont.	Engineer of Mines.
Minns, Raymond H., 1906, E. E. Pittsburg, Pa.	Student Apprentice, W. E. & M. Co.
Minor, Wells H., 1903, E. M. Box 124, Central City, Ky.	Mining Engineer, Central Coal & Iron Co.
Minton, LeRoy H., 1904, E. M. (Cer.) Perth Amboy, N. J.	Ceramic Chemist, Perth Amboy Terra Cotta Co.
Montgomery, Earl T., 1907, E. M. (Cer.) Burrage, Mass.	Ceramic Eng., with Wirt Mfg. Co.
Montgomery, John R., 1907, C. E. Columbus, Ohio.	With H. V. Ry.
Mooney, George L., 1903, E. E. Pittsburg, Pa.	With Westinghouse Elec. & Mfg. Co.
Moore, Ernest E., 1907, E. E. Schenectady, N. Y.	With Test. Dept., G. E. Co.
Moore, Frank A., 1907, M. E. Columbus, Ohio.	Gas Power Plant Work.
Moore, Harry C., 1907, B. Sc. (Chem.) Atlanta, Ga.	Chemist.
Morey, Paul C., 1906, E. E. Cincinnati, Ohio.	With Allis-Chalmers Co.
Morlan, Wilbert, 1903, M. E. Milwaukee, Wis.	With Allis-Chalmers Co.
Morris, Clyde T., 1898, C. E. Columbus, Ohio.	Associate Professor Civil Engineering, O. S. U.
Morris, Robert H., 1901, E. M. Masontown, Pa.	Supt., Roberts & Schaefer Co.
Morris, Willard B., 1903, M. E. Columbus, Ohio.	With C. E. Morris & Co., Structural Steel Works.

Morris, William B., 1902, M. E. Mt. Vernon, Ohio.	Draftsman, C. & G. Cooper Co.
Morrison, Robert O., 1893, C. E. Zanesville, Ohio.	Asst. Eng., M. of W., C. & M. V. R. R.
Morrow, Rush B., 1907, E. E. Cleveland, Ohio.	Inspector, American Tel. & Tel. Co.
Morse, George H., 1906, E. M. Las Esperanzas, Coah, Mexico.	Mine Engineer.
Morton, Elmer T., 1907, E. M. Holden, W. Va.	Mine Engineer.
Morton, George L., 1884, M. E. Washington, D. C.	Principal Examiner, Instruments of Precision, U. S. Patent Office.
Mougey, Wilbur E., 1907, E. E. Chicago, Ill.	With Western Electric Co.
Munn, Mortimer A., 1894, C. E. Baltimore, Md.	Civil Eng., with the Roberts-Abbott Co.
Murphy, Joseph L., 1903, C. E. Nelsonville, Ohio.	Chief Engineer, N. Y. Coal Co.
Myers, Albert B., 1900, E. M. Tepezala, Aguascalientes, Mex.	Superintendente, Minas Tepezalanas.
Myers, Ord, 1895, E. E. New York City.	Electrician, Metropolitan St. Railway Co.
Myers, Roy V., 1893, C. E. Knoxville, Tenn.	Civil and Mining Engineer.
Myers, Uriah H., 1887, E. M. Pittsburg, Pa.	Printer and Stationer, Myers & Shinkle.

N

Nagel, William G., 1895, M. E. Toledo, Ohio.	President and Manager, W. C. Nagel Electric Co.
Nauss, Ralph W., 1901, B. Sc. (Chem.)	
Needham, Harry S., 1900, M. E. Dennison, Ohio.	Assistant General Foreman, P., C., C. & St. L. R. R. Shops.
Nelson, Fred. B., 1905, C. E. 310 Ashband Blk., Chicago, Ill.	Hydraulic Engineer.
Nesbit, Chas. E., 1904, B. Sc. (Chem.) Wilkinsburg, Pa.	Chemist, Carnegie Steel Co.
Nesbitt, F. C., 1905, E. E. Columbus, Ohio.	Draftsman, Ralston Steel Car Co.
Newton, Samuel D., 1895, C. E. Knoxville, Tenn.	Civil Engineer, Southern Ry. Co.
Nichols, Harry B., 1903, C. E. Wheeling, W. Va.	With U. S. Tube Works.
Nicholson, C. M., 1900, E. E. Cincinnati, Ohio.	Foreman in Testing and Constructing Depts., Bullock Elec. Mfg. Co.
Nidy, Herbert C., 1901, E. E. Cleveland, Ohio.	With Cleveland Electric Railway Co.

Nold, John H., 1900, E. M. Columbus, Ohio.	Mine Engineer, Assistant to F. A. Ray.
Nold, Frederick B., 1905, E. M. Arcade, N. Y.	With Hoover & Kinnear.
Nurian, Kerson, 1899, M. E. St. Louis, Mo.	With Engineering Dept., Missouri Pacific Ry.
Nye, Ralph D., 1903, E. E. Pittsburg, Pa.	In Power Dept., Westinghouse Elec. & Mfg. Co.

O

O'Brine, David, 1881, B. Sc., M. S.; 1882, E. M., D. Sc., M. D. Urbana, Ohio.	Physician and Surgeon.
Ogden, Ellsworth,, 1905 Shawnee, Ohio.	Asst. Supt., Ohio Mining & Mfg. Co.
Orndorf, Earl L., 1903, B. Sc. (Chem.) Cincinnati, Ohio.	Assistant Chemist, Proctor & Gamble Co.
Orton, Edward, Jr., 1884, E. M. Columbus, Ohio.	Professor of Ceramics, O. S. U.

P

Pabodie, Robert J., 1899, M. E. Watertown, N. Y.	Salesman Engineer, Watertown Engineering Co.
Palmer, Walter K., 1893, M. E. 718 Dwight Bldg., Kansas City, Mo.	Consulting Mechanical and Electrical Engineer.
Park, Charles A., 1907, C. E. Cheyenne, Wyo.	Draftsman.
Parrett, Benj. C., 1902, B. Sc. (Chem.) Struthers, Ohio.	Chemist, Struthers Furnace Co.
Parsons, Charles H., 1907, M. E. Cleveland, Ohio.	With The Bruce-Meriam-Abbott Co.
Patch, Homer A., 1896, C. E. Minneapolis, Minn.	Draftsman, Minneapolis Steel & Machinery Co.
Payne, Halbert E., 1887, M. E. New York City.	President, American Typewriter Co.
Pearl, Allen S., 1894, E. E. Chicago, Ill.	Manager, Specialty Dept., Central Elec. Co.
Peirce, John M., 1895, E. E. Los Angeles, Cal.	With Home Telegraph & Telephone Co.
Pelton, Forrest B., 1904, E. E. Schenectady, N. Y.	In Testing Dept., General Electric Co.
Peppel, Samuel V., 1899, B. Sc. (Chem.) Columbus, Ohio.	Chemical Engineer.
Peters, William L., 1885, M. E. Riverside, Cal.	Horticulturist.

Petersen, John W., 1903, C. E. (Arch.) Canton, Ohio.	With American Bridge Co.
Pflueger, Edwin B., 1905, C. E. Cleveland, Ohio.	With the M. of W. Dept., Erie R. R. Co.
Pleukharp, C. V., 1885, M. E. La Crescenta, Cal.	Clergyman.
Pocock, Paul C., 1906, M. E. Columbus, Ohio.	With Elah Terrell, Contractor and Engineer.
Polk, Walter C., 1895, C. E. Birmingham, Ala.	Telephone Engineering and Construction.
Porterfield, John C., Jr., 1906, E. M.	
Postle, Herman R., 1894, C. E. South Pasadena, Cal.	Civil Engineer.
Poto, Frank B., 1901, B. Sc. (Chem.) Sta. C, Columbus, Ohio.	Chemist, Carnegie Steel Co.
Powell, Charles S., 1893, E. E. 111 Broadway, N. Y. City.	General Agent, Westinghouse Electric & Mfg. Co.
Powell, Ivan E., 1904, E. E. Rochester, N. Y.	Engineering Assistant, Rochester Ry. & Light Co.
Pratt, Fred. Kellogg, 1900, C. E. Colorado Springs, Col.	Teacher of Mathematics, High School.

R

Rawson, Levi, 1899, C. E. Sistersville, W. Va.	Engineer, Carter Oil Co.
Ray, Frank A., 1887, E. M. Columbus, Ohio.	Professor of Mine Engineering, Ohio State University.
Ray, William M., 1893, C. E. Cleveland, Ohio.	Asst. Eng. of Const., B. & O. R. R. Co.
Raymond, Coles A., 1894, C. E. Toledo, Ohio.	Asst. Engineer, American Bridge Co.
Reed, G. Nathaniel, 1903, M. E. Youngstown, Ohio.	Draftsman, with The William Tod Co.
Reed, Robert B., 1896, E. E. Akron, Ohio.	Electrical Contractor and Engineer.
Reed, William A., 1897, E. M. Telluride, Col.	Assistant Supt., Liberty Bell Gold Mining Co.
Reif, Charles C., 1906, M. E. Chicago, Ill.	With Western Electric Co.
Ribot, Antonio y C., 1904, E. E. San Juan, P. R.	Electrical Engineer.
Rice, Herbert A., 1897, C. E. Lawrence, Kas.	Associate Professor of Civil Engineering, Univ. of Kan.
Rice, Ray H., 1904, C. E. Norfolk, Va.	Construction Work, Tidewater Railway.
Riddile, John S., 1904, E. E. New York City.	With R. D. Mershon, 11 Pine street.
Riddle, Howard S., 1897, E. E. Columbus, Ohio.	Engineer, Jeffrey Mfg. Co.

Rigdon, Carl, 1905, M. E. Columbus, Ohio.	Asst. Professor of Experimental Engineering, O. S. U.
Rightmire, R. E., 1902, M. E. Columbus, Ohio.	Special Apprentice, Hocking Valley Railway Co.
Ripsch, Charles W., 1907, M. E. Dayton, Ohio.	Designer, Inventions Dept. No. 2, Nat. Cash Register Co.
Ritchie, George A., 1903, C. E. Columbus, Ohio.	Engineer, Construction, H. V. Ry.
Robinson, Erdis G., 1893, C. E. Columbus, Ohio.	Secy. and Treas. Robinson-Tilton Machinery Co.
Robinson, Richard W., 1905, C. E. Ambridge, Pa.	With American Bridge Co.
Robinson, Louis G., 1905, M. E. Louisville, Ky.	With Standard Sanitary Mfg. Co.
Rockhold, Cyrus K., 1907, E. M. Springfield, Ill.	Engineer, Springfield Colliery Co.
Rogers, James B., 1896, E. M. Ashland, Ky.	Supt., Blast Furnace.
Root, Willis J., 1885, E. M. Columbus, Ohio.	General Supt., Carnegie Steel Co., Columbus Works.
Rose, Claude C., 1905, M. E. Columbus, Ohio.	With Pneumatic Tool Co.
Ross, Calvin B., 1903, E. E. Springfield, Ohio.	Engineer and Draftsman, Hopper Mfg. Co.
Rowlee, Henry A., 1897, M. E. Philadelphia, Pa.	Inspector of Ordnance, U. S. A., Midvale Steel Works.
Royon, Eduoard D., 1904, M. E. Lynn, Mass.	In Testing Dept., General Electric Co.
Ruhlen, Carl M., 1898, M. E. Port Townsend, Wash.	Supt. of Construction, Quartermaster's Dept., U. S. A.
Ryland, Paul D., 1901, C. E. Bluefield, W. Va.	Roadmaster, Norfolk & Western Railway.

S

Sayers, Delbert B., 1905, E. M. Stonega, Va.	Chief Eng., Stonega Coal & Coke Co.
Sargent, Edward C., 1906, C. E. New Kensington, Pa.	The Pittsburg Reduction Co.
Schaaf, Downs, 1905, E. M. Omaha, Neb.	Laboratory of N. P. R. R. Co.
Schaub, E. L. T., 1885, M. E. Columbus, Ohio.	Draftsman, Jeffrey Mfg. Co.
Schaup, Charles E., 1897, E. M. Berrysburg, W. Va.	Chief Engineer, Southern Coal & Transportation Co.
Scheibell, Wm. O., 1888, E. M. Columbus, Ohio.	Consulting and Contracting Engineer for Concrete Construction.
Schertz, William A., 1904, E. E. Cincinnati, Ohio.	With Bullock Elec. Mfg. Co.
Schilling, Julius H., 1907, C. E. St. Louis, Mo.	Asst. Eng. Corps, St. Louis Div., Vandalia Ry.

Schlafly, Roydon K., 1903, C. E. Columbus, Ohio.	Assistant Professor of Civil Engineering, O. S. U.
Schlesinger, George F., 1907, C.E. Salem, Ill.	Asst. on Eng. Corps, Chicago & Eastern Illinois Ry.
Schneeberger, Grover B., 1907, E. E. Wilkinsburg, Pa.	Eng. Apprentice, W. E. & Mfg. Co.
Schreiber, George E., 1900, E. E. St. Louis, Mo.	Engineer and Contractor.
Schreiber, John M., 1899, E. E. Newark, N. J.	Engineer, M. of W., Public Service Corporation.
Schroll, Otto, 1886, C. E. Toledo, Ohio.	Supt., Toledo Division, Penna. Lines.
Schubert, C. W., 1903, C. E. Mt. Vernon, Ohio.	Draftsman, Mt. Vernon Bridge Works.
Schultz, August C., 1905, C. E. Sandusky, Ohio.	City Engineer.
Schupp, Peter V., 1906, E. E. 2268 Norwood Ave., East Norwood, Ohio.	Student Apprentice, Allis-Chalmers Co.
Schwab, Frank W., 1902, B. Sc. (Chem.) Newcomerstown, Ohio.	Chemist, James B. Clow & Sons.
Schwendt, Bernard J., 1907, E. E. Swissvale, Pa.	With U. S. & S. Co.
Sedgwick, Edgar C., 1895, E. E. Columbus, Ohio.	Chief Engineer, The Case Mfg. Co.
Senter, Herbert P., 1902, C. E. Columbus, Ohio.	In City Engineer's Office.
Serva, Adam A., 1893, E. E. Fort Wayne, Ind.	Assistant Sales Manager and Asst. Secy., Ft. Wayne Electric Works.
Shapter, G. H., 1905, E. E. Shenectady. N. Y.	With General Electric Co.
Sharp, Charles C., 1888, C. E. Gauley Bridge, W. Va.	Coal Mine Operator.
Shaw, Lucian, 1904, C. E. W. Lafayette, Ohio.	Contractor.
Sheldrick, Fred. F., 1907, E. E. Wilkinsburg, Pa.	Student Apprentice, W. E. & M. Co.
Shepard, Harvey L., 1903, B. Sc. (Chem.) Cincinnati, Ohio.	Chemist, Queen City Printing Ink Co.
Shepherd, C. W., 1900, C. E. Chicagfo, Ill.	In Structural Dept., North Works, Illinois Steel Co.
Sherman, Chris. E., 1894, C. E. Columbus, Ohio.	Professor of Civil Engineering, O. S. U.
Sherman, John K., 1901, C. E. Richmond, Ind.	Asst. Eng., Penna. Lines West of Pittsburg.
Shrock, John H., 1906, M. E. Bucyrus, Ohio.	With New York Blower Co.

SILL, EDGAR T., 1904, E. E. Pittsburg, Pa.	In Testing Dept., Westinghouse Elec. & Mfg. Co.
SIMON, TREVOR B., 1907, E. M. Lehigh, W. Va.	Mine Engineer.
SIMONTON, MARK, 1895, E. E. Columbus, Ohio.	Manager, Electric Supply & Construction Co.
SINGLETON, FRED., 1904, M. E. Columbus, Ohio.	With Hocking Valley R. R.
SKINNER, C. E., 1890, M. E. Pittsburg, Pa.	Engineer, Electrical Engineering Dept., Westinghouse Elec. & Mfg. Co.
SLAGER, JOHN C., 1907, E. E. Springfield, Ohio.	With Home Tel. Co.
SLOCTEMYER, CARL F., 1903, E. E. Cincinnati, Ohio.	In Eng. Dept., Cincinnati Traction Co.
SLOAN, NORTON Q., 1907, C. E. Dayton, Ohio.	With the Keppele Hall Co.
SMITH, CARL JOSEPH, 1905, E. M. Columbus, Ohio.	With Scioto Traction Co.
SMITH, DAVID W., 1899, C. E. Columbus, Ohio.	Division Engineer, Hocking Valley R. R.
SMITH, HARRY FORD, 1902, M. E. Lexington, Ohio.	Manager, Smith Gas Power Co.
SMITH, HOWARD DWIGHT, 1907, C. E. (Arch.) New York City.	Student in Columbia University.
SMITH, HUBERT P., 1906, M. E. Pittsburg, Pa.	
SMITH, ROY B., 1904, M. E. Columbus, Ohio.	Asst. Electrician, Motive Power Dept., Penna. Lines.
SMITH, WALTER G., 1907, C. E. New Philadelphia, Ohio.	Deputy County Surveyor.
SNIDER, C. M., 1897, B. Sc. (Ind. Arts) Columbus, Ohio.	Mechanical Engineer, The Jeffrey Mfg. Co.
SNOW, FRANKLIN C., 1906, E. E. Elyria, Ohio.	
SNYDER, JESSE C., 1907, E. E. Chicago, Ill.	With Western Electric Co.
SOSMAN, ROBERT B., 1903, B. Sc. (Chem.) Boston, Mass.	Chemist, with A. D. Little, Chemical Expert and Engineer.
SPERR, FREDERICK W., 1883, E. M. Houghton, Mich.	Professor of Civil and Mining Engineering, Michigan College of Mines.
SPERRY, WALTER A., 1907, B. Sc. (Chem.) Omaha, Neb.	Chemist, Union Pacific Ry., Laboratory.
SPITLER, GROVEY O., 1904, B. Sc. (Chem.) St. Louis, Mo.	With U. S. Fuel Testing Plant.
SPRAGUE, C. M., 1899, C. E. Chicago, Ill.	Assistant on Engineers' Corps, P., C., C. & St. L. Ry.

Sproat, Amasa D., 1902, E. M... Fresnilla, Zac., Mexico.	Supt., Fresnillo Mining Co.
Spurrier, John R., 1896, E. E....	
Staley, Judson J., 1907, M. E.... Dayton, Ohio.	Draftsman.
Staley, Marcellus, 1899, E. E... New York City.	Firm of Staley & Gillespie, Electrical Contractors.
Stanton, Fred. M., 1904, B. Sc. (Chem.) Pittsburg, Pa.	With U. S. Testing Laboratory.
Starbuck, Daniel K., 1899, E. E. Shenectady. N. Y.	With General Electric Co.
Stellhorn, Adolf, 1900, A. B.; 1903, C. E. Columbus, Ohio.	Assistant City Engineer.
Stewart, Harford T., 1896, E. E. Columbus, Ohio.	Secretary, Case Mfg. Co.
Stewart, Lee R., 1896, C. E..... Camden, N. J.	Engineer in Charge of Mold Loft, New York Ship Building Co.
Stewart, Walter S., 1905, E. M. 1417 S. 14th St., Denver, Col.	Engineer.
Stinebaugh, Isaac L., 1892, C. E. Tiffin, Ohio.	Asst. County Surveyor.
Stocker, James A., 1902, C. E.... Charleston, W. Va.	Division Engineer, Kanawha & Michigan Railway.
Stone, Carlton E., 1899, C. E.... Pittsburg, Pa.	With the P. & L. E. Ry.
Stone, Thomas W., 1902, M. E.. Fort Wayne , Ind.	Asst. Engineer, Western Gas Construction Co.
Storer, Norman W., 1891, E. E... Pittsburg, Pa.	Elec. Eng., Railway Dept., Westinghouse Elec. & Mfg. Co.
Storer, Simon B., 1893, E. E..... Buffalo, N. Y.	Gen. Man., Niagara, Lockport and Ontario Power Co.
Strait, Ralph H., 1907, E. M... Springfield, Ill.	Mine Engineer.
Straub, Albert A., 1906, M. E... Columbus, Ohio.	Assistant in Mechanical Engineering, O. S. U.
Strom, Lewis H., 1906, C. E...... Niagara Falls, N. Y.	With Buffalo, Thousand Islands & Portsmouth R. R.
Stull, Emmett W., 1894, E. E... Cincinnati, Ohio.	Engineer, Railway Dept., Bullock Elec. Mfg. Co.
Stull, Raymond T., 1902, E. M.. (Cer.) Mt. Savage, Mo.	With Andrew Ramsey, Mfgr. Enameled Brick.
Surface, Henry E., 1907, B. Sc. (Chem.) Washington, D. C.	Chem. Eng., Sec. Wood Chemistry, U. S. Dept. of Agriculture.

T

Taggart, John M., 1906, C. E.... Cambridge, Ohio.	With Penna. Lines.
Tanner, Edward W., 1902, M. E. Bedford, Ohio.	Draftsman, The Interstate Engineering Co.
Taylor, Arthur W., 1893, E. M.. Cleveland, Ohio.	Chemist, Otis Steel Co., Ltd.
Taylor, William O., 1904, E. E.. Cincinnati, Ohio.	Com'l Dept., Allis-Chalmers Co.
Templin, John R., 1903, M. E... Christ Church, New Zealand.	With General Electric Co.
Tenney, Edward H., 1905, M. E.. St. Louis, Mo.	Supt., Pipe Installation, Union Elec. Light & Power Co.
Thomas, Edward, 1904, B. Sc.... (Chem.) Copley, Pa.	Cement Inspector.
Thomas, George B., 1907, E. E... Boston, Mass.	Asst. in Elec. Lab., Mass. Institute of Technology.
Thomas, James O., 1897, C. E.... Columbus, Ohio.	Citizens Telephone Co.
Tillman, John H., 1907, M. E... Reading, Pa.	Supt. U. S. Brick Co.
Todd, Percy F., 1906, M. E....... Mt. Vernon, Ohio.	With C. & G. Cooper Co.
Towne, Robert S., 1879, B. Sc.; 1880, E. M. 82 Beaver St., New York City.	President, Campania Metallurgica Mexicana.
Tufts, Charles H., 1899, E. E... Pittsburg, Pa.	Chief Chemist, Shoenberger Wks., Am. Steel & Wire Co.
Turner, Arthur M., 1893, E. E.. 726 Farrell Ave., Chicago, Ill.	With Barnhart Bros. & Spindler.

U

Urban, Harry M., 1898, C. E.... Birmingham, Ala.	Department Engineer, U. S. Tube Works.

V

Van Dyke, C. S., 1902, E. E..... Shenectady. N. Y.	In Testing Dept., General Electric Co.
Van Tine, C. H., 1903, M. E..... Muncie, Ind.	Draftsman, Indiana Bridge Co.
Vandervoort, W. P., 1886, E. M.. Morrow, Ohio.	Supt. of Schools.
Vennum, Geo. C., 1905, M. E.... St. Louis, Mo.	With Union Electric Light & Power Co.
Viets, Willis B., 1886, E. M..... Pittsburg, Pa.	Chemist, Neville Furnace, Am. Steel & Wire Co.
Vosskuehler, J. H., 1900, M. E.. Madison, Wis.	Instructor in University of Wisconsin.

W

Wadsworth, F. L. O., 1888, E. M.; 1889, B. Sc., M. E. Pittsburg, Pa.	Chief Engineer, American Window Glass Co.
Walker, Downie R., 1905, M. E. Beloit, Wis.	With Fairbanks-Morse Co.
Walker, James M., 1896, C. E. Roanoke, Va.	Res. Eng., Tidewater R. R.
Walthour, Frederick D., 1906, M. E. 325 W. 58th St., N. Y. City.	With the New York Telephone Co.
Ward, Kenneth B., 1905, C. E. Columbus, Ohio.	Assistant in Civil Engineering, O. S. U.
Ward, Samuel E., 1904, M. E. Pittsburg, Pa.	With Westinghouse Machine Co.
Ward, Vernon C., 1903, M. E. Chicago, Ill.	Estimator, North Works, Illinois Steel Co.
Watson, William G., 1906, E. M. Lark, Utah.	With Bingham Consolidated Mining and Smelting Co.
Watt, Sern P., 1886, M. E. Seattle, Wash.	Mechanical Designer, Moran Bros. Co.
Watters, Burr S., 1904, M. E. Columbus, Ohio.	Asst. Eng., M. of W., Columbus Railway & Light Co.
Way, Karl M., 1905, E. M. St. Louis, Mo.	With U. S. Fuel Testing Plant.
Weaver, George H., 1905, M. E. Lorain, Ohio.	With Brown Cochran Gas Engine Co.
Webber, Frank M., 1903, E. E. Fort Wayne, Ind.	In Sales Dept., Fort Wayne Electric Works.
Weber, F. Clarence, 1901, B. Sc. (Chem.) Washington, D. C.	With Bureau of Chemistry, U. S. Agricultural Dept.
Weick, C. W., 1898, B. Sc. (Ind. Arts) New York City.	Instructor in Manual Training, Teachers' College, Columbia University.
Weinland, Herman G., 1905, M. E. Springfield, Ohio.	Asst. Supt., Lagonda Mfg. Co.
Welch, Clark J., 1888, C. E. 11 Broadway, New York City.	Bridge and Structural Engineer.
Welch, Oliver B., 1895, E. E. Dennison, Ohio.	General Manager, United Elec. Co.
Wellbaum, Arvy E., 1902, M. E. Mt. Gilead, Ohio.	Engineer, Hydraulic Press Co.
Welty, Albert B., 1906, B. Sc. (Ind. Arts) Racine, Wis.	With Case Threshing Machine Co.
Wilcox, Alva N., 1895, E. E. Dayton, Ohio.	The Pinneo & Daniels Co.
Wilcox, Carl C., 1903, M. E.; 1907, E. E. Columbus, Ohio.	With Col. Ry. & Lt. Co.

Wilkinson, Clarence M., 1906, M. E. Chicago, Ill.	With Otis Elevator Co.
Wilkinson, Fred. C., 1907, C. E. Wheeling, W. Va.	Asst. Eng., M. of W. Dept., Wheeling Terminal Ry. Co.
Williams, Ernest D., 1905, M. E. Shenectady. N. Y.	Steam Turbine Eng. Dept., General Electric Co.
Williams, Harry E., 1902, M. E. Omaha, Neb.	Special Apprentice, Union Pacific R. R. Shops.
Williams, Ralph D., 1906, E. E. Chicago, Ill.	With Western Electric Co.
Williams, S. B., 1905, E. E. Chicago, Ill.	Tel. Dept., Western Electric Co.
Williams, William S., 1907, E.E. Shenectady. N. Y.	In Testing Dept., G. E. Co.
Williamson, Arba G., 1906, E. E. 560 Washington Ave., Carnegie, Pa.	Signal Dept., Penna. R. R.
Williamson, H. D., 1901, B. Sc. (Chem.); M. D., Starling Medical College, 1904. Lorain, Ohio.	Physician.
Wise, Albert Joseph, 1898, C. E. Houston, Tex.	Civil Engineer.
Wise, James G., 1906, C. E. 17 W. 124th St., N. Y. City.	Draftsman, N. Y. C. & H. R. R. R.
Wolf, Herman H., 1895, C. E. Washington, D. C.	Lieutenant, U. S. Revenue Cutter Service.
Wolfe, Arthur C., 1905, M. E. Mt. Vernon, Ohio.	With C. & G. Cooper Co.
Wyer, Samuel S., 1903, M. E. Highland St., Columbus, Ohio.	Manufacturer Gas Specialties.
Wylie, Arthur R., 1905, M. E. Spokane, Wash.	With Fairbanks-Morse Co.
Wynne, Francis E., 1902, E. E. Pittsburg, Pa.	With Westinghouse Electric & Manufacturing Co.

Y

Yost, Lloyd, 1902, M. E. Warren, Pa.	With Struthers, Wells & Co.
Youmans, Wm. R., 1903, E. E. Shenectady. N. Y.	In Testing Dept., General Electric Co.

Z

Zaumseil, Oscar C., 1887, C. E. Webb City, Mo.	Merchant.
Zeller, Howard P., 1906, E. M. Las Esperanzas, Coah., Mex.	Eng., with Mexican Coal & Coke Co.
Zurfluh, Wm. N., 1894, E. E. Springfield, Ohio.	Supt., Home Lighting, Power & Heating Co.

The Ohio State University Bulletin is issued fifteen times during the academic year; monthly in October, November, and June, and bi-weekly in December, January, February, March, April, and May.

VOLUME XIII NUMBER 15

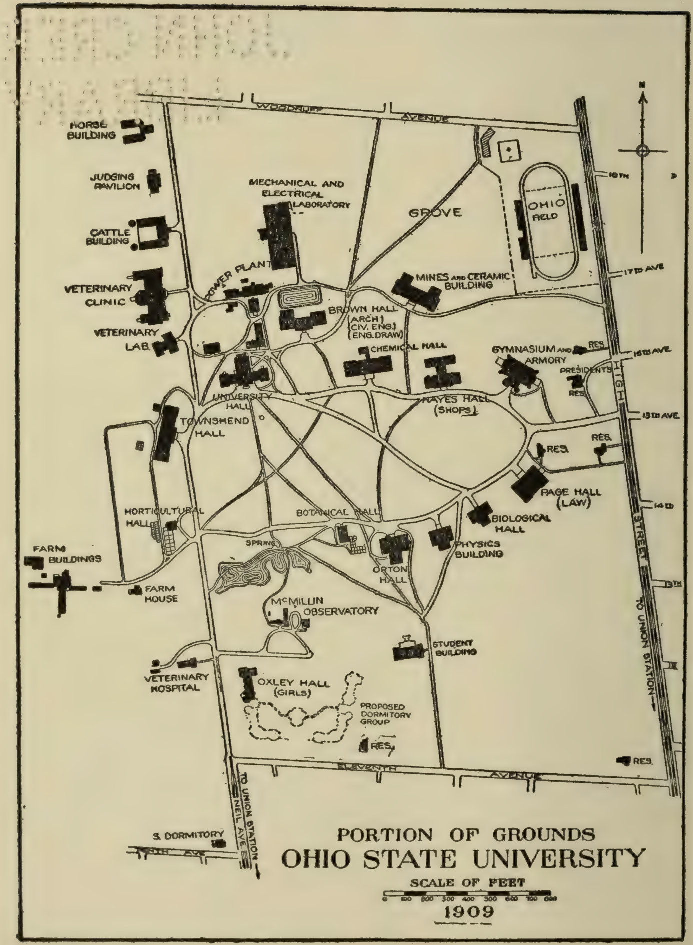
Ohio State University Bulletin

College of Engineering

Part I

March 25, 1909

PUBLISHED BY THE UNIVERSITY AT COLUMBUS
Entered as second-class matter November 17, 1905, at the postoffice at Columbus, Ohio, under Act of Congress, July 16, 1894.



PORTION OF GROUNDS
OHIO STATE UNIVERSITY

1909

OHIO STATE UNIVERSITY

The Ohio State University, located in Columbus two miles north of the Union Station, is a part of the public educational facilities maintained by the State. It comprises seven colleges:

The College of Agriculture and Domestic Science,
The College of Arts, Philosophy, and Science,
The College of Education,
The College of Engineering,
The College of Law,
The College of Pharmacy,
The College of Veterinary Medicine.

This bulletin of announcements is devoted exclusively to the work of the College of Engineering.

(NOTE.—In requesting any of the announcement bulletins of the University, address the University Editor, Ohio State University, Columbus, Ohio.)

UNIVERSITY CALENDAR

1909

Entrance examinations, (8 a. m.) Tuesday to Saturday, June 15 to 19.

Summer Course in Surveying, June 18 to July 17.

Summer Course in Shopwork, June 21 to July 17.

Summer term, June 21 to August 13.

Entrance examinations, (8 a. m.) Tuesday to Saturday, September 14 to 18.

First term begins—Registration Day—Tuesday, September 21.

President's Annual Address, (11 a. m.) Friday, September 24.

Latest date of admission to candidacy for a degree at the Commencement of June, 1910, Friday, October 1.

Thanksgiving recess, November 25, 26, and 27.

Latest date for filing thesis subject, Wednesday, December 15.

First term ends Wednesday, December 22.

CHRISTMAS VACATION

1910

Second term begins—Registration Day—Tuesday, January 4.

Washington's Birthday, Tuesday, February 22.

Second term ends, Friday, April 1.

SPRING RECESS

Third term begins—Registration Day—Wednesday, April 6.

Field Day—Athletic Association—Saturday, May 7.

Competitive Drill—Cadet Regiment—Saturday, May 21.

Final examinations, Friday to Thursday, June 10 to 16.

Latest date for presenting thesis, Saturday, June 11.

Entrance examinations, (8 a. m.) Tuesday to Saturday, June 14 to 18.

Latest date for filing bound copy of thesis, Friday, June 17.

Commencement, Wednesday, June 22.

COLLEGE OF ENGINEERING

COURSES OFFERED

This college offers instruction in nine important fields of engineering work. Covering these the following four-year courses of study are offered:

1. Architecture, leading to the degree of Civil Engineer in Architecture (C. E. in Arch.).

2. Ceramic Engineering, leading to the degree of Ceramic Engineer (Cer. E.).

3. Chemical Engineering, leading to the degree of Bachelor of Science in Chemical Enginering (B. Sc.).

4. Civil Engineering, leading to the degree of Civil Engineer (C. E.)

5. Electrical Engineering, leading to the degree of Mechanical Engineer in Electrical Engineering (M. E. in E. E.).

6. Industrial Arts, leading to the degree of Bachelor of Science in Industrial Arts (B. Sc.).

7. Manual Training, leading to the degree of Bachelor of Science in Industrial Arts (B. Sc.).

8. Mechanical Engineering, leading to the degree of Mechanical Engineer (M. E.).

9. Mine Engineering, leading to the degree of Engineer of Mines (E. M.)

The following two-year, or short courses, do not lead to a degree, but students completing them are furnished a formal certificate stating the work they have accomplished:

10. Clay-working.
11. Industrial Arts and Shopwork.
12. Mining.

FACULTY AND INSTRUCTORS

WILLIAM OXLEY THOMPSON, D. D., LL. D., PRESIDENT OF THE UNIVERSITY.

SIDNEY AUGUSTUS NORTON, Ph. D., LL. D., Emeritus Professor and Lecturer in Chemistry.

STILLMAN W. ROBINSON, C. E., D. Sc., Emeritus Professor of Mechanical Engineering.

ROBERT WHITE MCFARLAND, LL. D., Emeritus Professor of Civil Engineering.

FRANCIS CARY CALDWELL, B. A., M. E., ACTING DEAN, Professor of Electrical Engineering.

JAMES ELLSWORTH BOYD, M. S., SECRETARY and Professor of Mechanics.

NATHANIEL WRIGHT LORD, E. M., Professor of Metallurgy and Mineralogy and Director of the School of Mines.

EDWARD ORTON, JR., E. M., Professor of Ceramic Engineering and Director of the Department.

BENJAMIN FRANKLIN THOMAS, Ph. D., Professor of Physics.

ROSSER DANIEL BOHANNAN, B. Sc., C. E., E. M., Professor of Mathematics.

BENJAMIN LESTER BOWEN, Ph. D., Professor of Romance Languages and Literatures.

JOSEPH VILLIERS DENNEY, B. A., Professor of English.

WILLIAM THOMAS MAGRUDER, M. E., Professor of Mechanical Engineering.

WILLIAM MCPHERSON, JR., D. Sc., Ph. D., Professor of Chemistry.

JOSEPH NELSON BRADFORD, M. E., Professor of Architecture.

FRANK EDWIN SANBORN, S. B., Professor of Industrial Arts and Director of the Department.

FRANK ARNOLD RAY, E. M., Professor of Mine Engineering.

HENRY CURWEN LORD, B. Sc., F. R. A. S., Professor of Astronomy and Director of the Emerson McMillin Observatory.

EMBURY ASBURY HITCHCOCK, M. E., Professor of Experimental Engineering.

CHARLES SMITH PROSSER, Ph. D., Professor of Geology.

CHRISTOPHER ELIAS SHERMAN, C. E., Professor of Civil Engineering.

LEWIS ADDISON RHOADES, Ph. D., Professor of Germanic Languages and Literatures.

FRANK HARVEY ENO, B. Sc., C. E., Professor of Municipal Engineering.

THOMAS EWING FRENCH, M. E., Professor of Engineering Drawing.

GEORGE WASHINGTON MCCOARD, M. A., Professor of Mathematics.

WILLIAM EDWARDS HENDERSON, Ph. D., Professor of Inorganic and Physical Chemistry.

CHARLES A. BRUCE, B. A., Professor of the Romance Languages.

CHARLES WILLIAM FOULK, B. A., Professor of Analytical Chemistry.

MATTHEW BROWN HAMMOND, Ph. D., Professor of Economics and Sociology.

CLYDE T. MORRIS, C. E., Professor of Structural Engineering.

KARL DALE SWARTZEL, M. Sc., Professor of Mathematics.

*EDWARD ELSWORTH SOMERMEIER, G. Ph., Associate Professor of Metallurgy and Mineralogy.

HARRY WALDO KUHN, Ph. D., Professor of Mathematics.

FREDERICK EDWARD KESTER, Ph. D., Associate Professor of Physics.

CHARLES LINCOLN ARNOLD, M. Sc., Associate Professor of Mathematics.

---

*Absent on leave, 1908-1909.

EDWIN F. CODDINGTON, Ph., D., Associate Professor of Mechanics.

WILLIAM LLOYD EVANS, Ph. D., Associate Professor of Chemistry.

BERTHOLD AUGUST EISENLOHR, M. A., Associate Professor of the Germanic Languages and Literatures.

SAMUEL EUGENE RASOR, B. Sc., Associate Professor of Mathematics.

JOHN HERMAN HUNT, B. S. in E. E., Associate Professor in Electrical Engineering.

ROSS C. PURDY, Cer. E., Associate Professor of Ceramic Engineering.

CHARLES ST. JOHN CHUBB, Jr. C. E. (Arch.), Associate Professor of Architecture.

ROBERT F. EARHART, Ph. D., Assistant Professor of Physics.

WILLIAM ABNER KNIGHT, M. E., Assistant Professor of Machine-Shop Practice.

HORACE JUDD, M. E., M. Sc., Assistant Professor of Experimental Engineering.

CARSON SAMUEL DUNCAN, M. S., Assistant Professor of English.

ROY K. SCHLAFLY, C. E., Assistant Professor of Civil Engineering.

THOMAS KENYON LEWIS, B. Sc., Assistant Professor of Engineering Drawing.

JAMES RENWICK WITHROW, Ph. D., Assistant Professor of Chemistry.

EDMUND SEWALL MANSON, JR., M. S., Assistant Professor of Astronomy.

ROBERT MEIKLEJOHN, M. E., Assistant Professor of Engineering Drawing.

RALPH ROGERS, B. S. in M. E., Assistant Professor of Engineering Drawing.

CARL RIGDON, M. E., Assistant Professor of Experimental Engineering.

OLIVER C. LOCKHART, M. A., Assistant Professor of Economics and Sociology.

WALTER LYMAN UPSON, M. E. E., Assistant Professor of Electrical Engineering.

DANA J. DEMOREST, B. Sc. (Chem. Eng.), Acting Assistant Professor of Metallurgy and Mineralogy.

CHARLES C. MORRIS, M. A., Assistant Professor of Mathematics.

ADOLPH BUSSE, Ph. D., Assistant Professor of the Germanic Languages and Literatures.

JOHN ROSS CHAMBERLIN, Assistant Professor of Civil Engineering.

OLIVE JONES, B. A., Librarian.

GEORGE L. CONVERSE, Captain U. S. A. (Retired), Professor of Military Science and Tactics.

H. SHINDLE WINGERT, M. D., Director of Physical Education for Men.

JOHN ADAMS BOWNOCKER, D. Sc., Professor of Inorganic Geology and Curator of the Museum.

DAVID R. MAJOR, Professor of Psychology.

JAMES EDWARD HAGERTY, Ph. D., Professor of Economics and Sociology.

WILLIAM LUCIUS GRAVES, M. A., Associate Professor of English.

EDGAR S. INGRAHAM, Ph. D., Associate Professor of Romance Languages.

FAYETTE A. MCKENZIE, Ph. D., Assistant Professor of Economics and Sociology.

GEORGE D. HUBBARD, Ph. D., Assistant Professor of Geology.

CHARLES PHILIP CROWE, Instructor in Forging.

JOHN SATTERLEE TIDBALL, B. S., Instructor in Engineering Drawing.

MAY THOMAS, Ph. D., Instructor in German.

FRANK KELTON BAILEY, Ph. D., Instructor in Physics.

W. J. NORRIS, Instructor in Engineering Drawing.

CLARENCE CHARLES VOGT, A. B., Instructor in Chemistry.

ALLANDO CASE, Instructor in Vise Work.

C. W. BEEM, Instructor in Patternmaking and Founding.

F. H. HASKETT, Instructor in Architecture.

CHARLES S. SHEARD, M. A., Instructor in Physics.

GEORGE ROBERT BOTT, M. E., Instructor in Engineering Drawing.

CLARENCE A. DYKSTRA, B. A., Instructor in American History and Political Science.

SAMUEL MORRIS, Instructor in Chemistry.

KENNETH BAKER WARD, C. E., Assistant in Civil Engineering.

WESLEY G. WORCESTER, Instructor in Ceramic Engineering.

ULYSSES W. DENMAN, Assistant in Patternmaking.

H. G. CARPENTER, Student Assistant in Mine Engineering.

ALFRED HENRY BARNES, Assistant in Physics.

J. THOMAS KIBLER, Assistant in Physical Education for Men.

CLIFFORD SHOEMAKER, C. E., Assistant in Civil Engineering.

CHARLES E. FISHER, M. E., Assistant in Mechanical Engineering.

C. E. McQUIGG, Assistant in Metallurgy and Mineralogy.

D. R. KELLOGG, Assistant in Physics.

HOWARD J. LUCAS, B. A., Assistant in Chemistry.

FELLOWS

GERALD PIERCE LAWRENCE, M. E., Robinson Fellow in Engineering.

LEROY W. ROUSH, M. E. in E. E., Fellow in Electrical Engineering.

*JAMES PARK CALDERWOOD, M. E., Fellow in Experimental Engineering.

CHARLES C. GRANT, Fellow in Experimental Engineering.

---

*Resigned, April 1, 1909.

ADMISSION

Applicants for admission must be at least seventeen years of age. The College is open on equal terms to both sexes.

UNIVERSITY ENTRANCE BOARD

The admission of students is in charge of the University Entrance Board, which determines the credits which shall be issued on all entrance examinations and certificates, and furnishes all desired information to applicants. Correspondence relating to admission should be addressed to the Entrance Board, Ohio State University, Columbus.

ADMISSION TO THE COURSE LEADING TO A DEGREE

There are two modes of admission to the course leading to a degree: (a) by examination, (b) by certificate.

ADMISSION BY EXAMINATION

The Entrance Board will conduct entrance examinations June 15 to 19 and September 14 to 18, 1909. A part of the examinations may be taken in June and the remainder in September. All applicants for admission who are not graduates of an accredited or recognized secondary school or approved preparatory school, or who do not possess certificates from the State Board of School Examiners, must take examinations for admission.

Schedule.—Examinations will be from 8 to 12 a. m. and from 1 to 5 p. m.

Tuesday	a. m.	History: Greek and Roman, English, General.
“	p. m.	Composition and Rhetoric, Classics, Chemistry, Geology.
Wednesday	a. m.	Algebra, German, English Grammar, Descriptive Geography.
“	p. m.	Plane Geometry, Physical Geography, Arithmetic.
Thursday	a. m.	Civics, Solid Geometry, Zoology.
“	p. m.	Beginning Latin, Caesar, Astronomy, Elements of Agriculture.
Friday	a. m.	Physics, Physiology, Botany.
“	p. m.	U. S. History, French, English Literature.
Saturday	a. m.	Vergil, Cicero.

ADMISSION BY CERTIFICATE

Applicants may be admitted without examination on presentation of properly indorsed certificates from such secondary schools as have been accredited* or recognized by the University, or from approved normal schools, or from the State Board of School Examiners under the following provisions:

(a) If from secondary schools, the certificate must show that the applicant is a graduate in good standing of the school issuing it; and also must state in detail the studies pursued, the text-books used, the amount of work done in each study, the amount of time devoted to it, and the fact that the applicant has passed in the work.

(b) Any entrance requirement not covered by a certificate must be met by examination.

Blank certificates may be obtained by addressing the Secretary of the Entrance Board. Certificates should be filled out and returned to the University as early as possible after the close of schools in June. Since errors are frequently made in transcribing the school record on the blank form, the applicant should verify his certificate before presenting it to the Entrance Board, and see that it gives him credit for all his school work.

REQUIREMENTS BY UNITS

A unit is the equivalent of a course of study covering a school year of not less than thirty-six weeks, with five periods of at least forty-five minutes each per week. To obtain full standing, applicants under twenty-one years of age must have credit by examination or certificate for fifteen units—of which three shall be English, one history, three mathematics (including solid Geometry), one physics, and four language other than English—selected from the following list:

---

*For information regarding these schools consult the bulletin on Entrance Information, which will be sent on request.

English	3 units
(Foreign students may substitute their native language for the English requirement.)	
American History or American History and Civil Government	1 unit
Ancient History (Greek and Roman) and Medieval History to 814 A. D.	1 unit
Medieval and Modern History (from 814 A. D. to the present)	1 unit
(For the present General History may be counted as a unit, but not in addition to Ancient or Medieval and Modern History.)	
English History	1 unit
Algebra (through quadratics)	1 unit
Algebra (beyond quadratics)	½ unit
Geometry (plane)	1 unit
Geometry (solid)	½ unit
Trigonometry	½ unit
Latin	2, 3, or 4 units
Greek	2, 3, or 4 units
German	2, 3, or 4 units
French	2, 3, or 4 units
Spanish	2, 3, or 4 units
(Not less than two units of any language will be accepted.)	
Physics	1 unit
Chemistry	1 unit
Physical Geography	1 unit
Zoology	1 unit
Botany	1 unit
Physical Geography Zoology Botany Physiology For the present any two of these may be counted together as	1 unit
Agriculture Free-hand Drawing* Manual Training Domestic Science The Entrance Board may, after investigating each claim, grant a total credit of not to exceed	2 units

---

*Students expecting to enter the College of Engineering are advised to take free-hand drawing in the high school.

Preparation in excess of the requirement in any subject will not be credited unless it amounts to one-half unit.

No student under twenty-one years of age will be admitted to college if he is conditioned in more than two of the fifteen units. All entrance conditions must be removed within two years after admission.

An applicant twenty-one years of age or over, who is deficient in foreign language training will be admitted with a total deficiency of four units, provided at least two of the four are in the foreign language group.

Students over twenty-one years of age are admitted in accordance with the provisions stated under "Admission to Studies," page 15.

The extent and character of the work required in each subject mentioned above is explained in a special bulletin which will be sent to any address upon request by the University Editor. In general it may be stated that the definitions of the North Central Association of College and Secondary Schools are accepted as our definitions.

ADMISSION WITH ADVANCED STANDING

Applicants who have completed at least one year's work in an approved college, and who bring official and explicit certificates describing their courses of study and scholarship, and letters of honorable dismissal, will be admitted in accordance with either of two plans:

(1) The entrance units on which the candidate was admitted to the approved college will be accepted at their face value; deficiencies will be made up from the college credits presented, and advanced credit will be given for any remaining satisfactory work; or

(2) One year's work will be accepted in lieu of entrance units and the candidate will be admitted without examination and without conditions, but without any advanced standing on the year's work.

Applicants who have completed less than one year's work in an approved college must satisfy the entrance requirements in the usual way, and will then be given credit for any satisfactory work for which they can offer certificates.

ADMISSION TO SPECIAL STUDIES

Students who desire to pursue special lines of work in the University, and do not intend to become candidates for degrees, will be admitted on the following conditions:

1. The regular entrance requirements must be satisfied.

But applicants who are not less than twenty-one years of age, after obtaining credit for elementary or "grade" work, and for such other subjects as may be necessary to qualify them for the classes that they wish to enter, may, on the presentation of satisfactory reasons, be admitted by the joint action of the Entrance Board and the Executive Committee of the College, to any class in the College; provided, that if any student who has been admitted on these conditions afterwards becomes a candidate for a degree, he shall pass the omitted entrance examinations at least one academic year before the degree is conferred.

2. Before entering the College, students desiring to pursue special work are required to lay before the Executive Committee, for approval or modification, a written statement of the end they have in view, the studies proposed for the attainment of that end, and the probable period of attendance. Such students will be held as strictly to their accepted schemes of work as are the regular undergraduates to their courses of study.

3. Permission to enter as special undergraduates will be refused to all who fail to give satisfactory evidence of definiteness of purpose and will be withdrawn whenever the conditions on which it was granted cease to exist.

ADMISSION TO THE SHORT COURSES

Applicants must be at least seventeen years of age, and, unless they are over twenty-one years of age, must pass examinations in Arithmetic and Georgraphy, and must be able to write a business letter or a short theme, correct in grammar and orthography; or they must present satisfactory certificates showing that they have successfully pursued these subjects elsewhere. In addition, each applicant under twenty-one years of age must present a letter or certificate showing that he has had at least one year's practical experience in some industry related to the course which he wishes to pursue.

Applicants over twenty-one years of age are admitted without examination, and without letter or certificate of practical experience.

REMOVAL OF ENTRANCE CONDITIONS

The removal of entrance conditions is administered by the Entrance Board. Conditions may be removed (1) by examination (for schedule of examinations see page 11); or (2) by the substitution of excess work in other approved subjects; or (3) by the substitution of other equivalent work to be done at the University at such time and in such subjects as the Entrance Board shall direct. All entrance conditions must be removed before the beginning of the third year of residence at the University, and a condition in Physics before the beginning of the second year.

COURSES OF STUDY

OUTLINE OF THE FIRST YEAR'S WORK OF ALL FOUR-YEAR COURSES

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department; the other figure indicates the number of credit hours.

First Term		Second Term		Third Term	
Mathematics (31) Algebra.	5.	Mathematics (32) Trigonometry.	5.	Mathematics (33) Analytics.	5.
Chemistry (7 or 44) Inorganic.	4.	Chemistry (7 or 44) Inorganic.	4.	Chemistry (12) Qualitative Analysis.	4.
Modern Language French, Ger. or Span.	4.	Modern Language French, Ger. or Span.	4.	Modern Language French, Ger. or Span.	4.
English (1) Para. Writing.	2.	English (2) Expos. Writing.	2.	English (3) Brief Making.	2.
Eng. Drawing (1) Elem. Mechan.	2.	Eng. Drawing (2) Lettering.	2.	Eng. Drawing (3) Mech. Draw.	3.
Military Drill	1.	Military Drill	1.	Military Drill	1.
Gymnasium	1.	Gymnasium	1.	Gymnasium	1.

Students presenting Chemistry as an entrance subject will take Chemistry 44.

Summer Term in Shopwork—Students electing courses named below are required to take Shopwork courses in the summer term as follows:

Chemical Engineering—Shopwork (7) and (11) at the close of the first or second year.

Ceramics, Electrical Engineering, and Mechanical Engineering—Two from Shopwork (4), (7), and (11), at the close of the first year.

Industrial Arts—Shopwork (7) and (11), at the close of the first year.

COURSE IN ARCHITECTURE

FOR OUTLINE OF FIRST YEAR SEE PAGE 17.

SECOND YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
Architecture (9) Hist. of Architecture.	3.	Architecture (10) Hist. of Architecture.	3.	Architecture (11) Hist. of Architecture.	3.
Architecture (12) The Orders.	2.	Architecture (13) Order Problems.	3.	Architecture (14) Order Problems.	3.
Eng. Drawing (33) Projections.	3.	Eng. Drawing (36) Descriptive Geometry.	5.	Architecture (26) Arch. Perspective.	5.
Drawing (42) Charcoal Drawing from Arch. Ornament.	2.	Drawing (14) Pen Drawing.	2.	Drawing (14) Pen Drawing.	2.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	4.				
Military Drill	1.	Military Drill	1.	Military Drill	1.

SUMMER WORK

THIRD YEAR

Architecture (15) Designing.	4.	Architecture (23) Designing.	4.	Architecture (17) Designing.	4.
Architecture (5) Decoration, etc.	5.	Architecture (27) Stereotomy.	3.	Architecture (24) Structural Details.	5.
Architecture (22) Arch. Composition.	2.	Drawing (18) Water Color.	2.	Drawing (19) Water Color.	2.
Architecture (33) Photography.	2.	Drawing (40) Clay Modeling.	2.	Drawing (41) Clay Modeling.	2.
Mechanics (1) Statics.	5.	Mechanics (2) Strength Materials.	5.	Civil Eng. (19) Trusses.	5.
		Civil Eng. (14) Cement Work.	2.		

SUMMER WORK

FOURTH YEAR

Architecture (18) Designing.	4.	Architecture (21) Designing.	4.	Architecture (19) Designing.	4.
Architecture (25) Plumbing.	2.	Architecture (4) Specifications.	2.	Architecture (29) Professional Practice.	2.
Architecture (30) Monumental Design.	3.	Architecture (28) Estimating.	2.	Architecture (20) Thesis.	5.
Drawing (43) Charcoal Drawing from Antique.	2.				
Civil Eng. (34) Masonry.	3.	Civil Eng. (28) Steel Construction.	5.	Civil Eng. (21) Surveying.	3.
Mech. Eng. (23) Materials of Constr.	4.	Mech. Eng. (42) Heating and Vent.	3.	Civil Eng. ( ) Reinforced Concrete,	2.

THESIS

COURSE IN CERAMIC ENGINEERING

FOR OUTLINE OF FIRST YEAR SEE PAGE 17.

Summer Term.—Students are required to take *two* of the following courses in shopwork in the summer term at the close of the first year: Shopwork (4), (7), and (11).

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department; the other figure indicates the number of credit hours.

SECOND YEAR

First Term		Second Term		Third Term	
†Drawing (33) Projection Drawing.	3.	†Drawing (34) Descriptive Geometry.	3.	†Drawing (35) Adv. Descriptive Geom.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (31) Mechanics, Heat.	5.	Physics (32) Elect'y, Magnetism.	5.	Physics (32) Light, Sound.	5.
Ceramics (1) Laboratory.	5.	Ceramics (2) Laboratory.	5.	Ceramics (3) Laboratory.	3.
				Ceramics (24) Ceramic Calculation.	2.
Military Drill	1.	Military Drill	1.	Military Drill	1.

THIRD YEAR

Mechanics (1) Statics.	5.	Mechanics (2) Str'n'th Mat'ls, Kinet.	5.	Mech. Eng. (43) Mechanism.	5.
Ceramics (4) Raw Materials.	5.	Ceramics (5) Preparation and Mnfr.	5.	Ceramics (6) Drying and Burning.	5.
Mine Eng. (4) Mine Surveying.	5.	Chemistry (30) Phys. Chem. Lectures.	3.	Ceramics (26) Phys. Chem. Meas.	5.
Architecture (33) Photography.	2.	Ceramics (25) Identification of Clays.	3.	Ceramics (27) Decoration of Clay Wares.	3.

FOURTH YEAR

Ceramics (9) Manf. of Bodies.	5.	Ceramics (10) Glasses and Glazes.	5.	*Ceramics (11) Enamels, Colors.	5.
Metallurgy (4) Fuels and Iron.	5.	Civil Eng. (19) Trusses.	5.	*Ceramics (12) Cement.	5.
Geology (2) General.	5.	Geology (6) Economic.	3.	Ceramics (15) Thesis Work.	5.
		Geology (7) Petrography.	2.	Mech. Eng. (36) Laboratory.	5.
Drawing (21) Technical Draw.	2.	Drawing (22) Technical Draw.	2.	Drawing (23) Technical Draw.	2.

THESIS

---

*Students are to elect Ceramics (11) or (12).

†For 1909-1910 only.

COURSE IN CHEMICAL ENGINEERING

FOR OUTLINE OF FIRST YEAR SEE PAGE 17.

SUMMER TERM—Shopwork Courses (7) 3 and (11) 3 are to be taken in the summer term at the close of the first or second year.

NOTE.—The figure in parenthesis following the name of each study indicates the number of the study in its department; the other figure indicates the number of credit hours.

SECOND YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
Chemistry (20)	4.	Chemistry (20)	4.	Chemistry (20)	4.
Chemistry (21)	2.	Chemistry (21)	2.	Chemistry (21)	2.
Physics (2)	3.	Physics (2)	3.	Physics (2)	3.
Mathematics (41)	5.	Mathematics (42)	5.	Mathematics (43)	5.
†Drawing (33)	3.	†Drawing (34)	3.	Metallurgy (2)	3.
Chemistry (40)	1.	Chemistry (40)	1.		
Military Drill	1.	Military Drill	1.	Military Drill	1.

THIRD YEAR

Required		Required		Required	
Mechanics (1)	5.	Mechanics (2)	5.	Mechanics (3)	5.
Drawing (21)	2.	Drawing (22)	2.	Drawing (23)	2.
Chemistry (46)	2.	Chemistry (46)	2.	Chemistry (46)	2.
Chemistry (47)	2.			Mech. Eng. (32)	5.
Metallurgy (4)	5.				
Elective 2 to 3 hrs.		*Elective 7 to 10 hrs.*		*Elective 3 to 5 hrs.*	
Metallurgy ( )	3.	Chemistry (47)	2-3.	Chem. (47)	2 or 3.
Chemistry (17)	2.	Chem. (17)	2 or 3.	Chem. (48)	3 to 5.
		Chem. (77)	2.	Chem. (15)	4.
		Metal (4)	5.	Metal ( )	3.
		Metal (6)	5.		

FOURTH YEAR

Chem. (32)	4.	Chem. (32)	4.	Chem. (71)	4.
Mech. Eng. (18)	5.	Mech. Eng. (18)	5.	Mech. Eng. (19)	5.
Chem. (30)	3.	Chem. (30)	3.		
Elec. Eng. (5)	4.	*Elective	3.	*Elective	6.
*Elective	2.	Thesis	3.	Thesis	3.

Chemistry 78 or 79 is taken at the end of the first or second term.

---

*These electives must be approved by the head of the Department of Chemistry, or in case of those students specializing in metallurgical chemistry, by the head of the Department of Metallurgy.

†For 1909-1910 only.

COURSE IN CIVIL ENGINEERING*

FOR OUTLINE OF FIRST YEAR SEE PAGE 17.

SECOND YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
Math. (41) Calculus.	5.	Math. (42) Calculus.	5.	Math. (43) Calculus.	5.
Physics (2) Mech. and Heat.	4.	Physics (2) Elect. and Magnetism.	4.	Physics (2) Light and Sound	3.
Civil Eng. (30) Surveying.	5.	Civil Eng. (4) Topog. Drawing.	4.	Civil Eng. (32) R. R. Surveying.	5.
Civil Eng. (31) Field Practice.	1.			Civil Eng. (33) Field Practice.	1.
Eng. Draw. (34) Descriptive Geom.	3.	Eng. Draw. (36) Descriptive Geom.	5.	Civil Eng. (6) Stereotomy.	4.
Military Drill	1.	Military Drill	1.	Military Drill	1.

SUMMER COURSE.—Civil Engineering (22) 4 weeks, of 6 days per week. Field work in surveying.

THIRD YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
Mechanics (1) Statics.	5.	Mechanics (2) Strength Materials.	5.	Mechanics (3) Kinetics.	5.
Civil Eng. (3) Topog. Surveying.	4.	Civil Eng. (24) Timber Construction.	4.	Civil Eng. (7) Stresses.	5.
Civil Eng. (16) Roads and Streets.	4.	Civil Eng. (14) Cement Testing.	2.	Civil Eng. (10) Sanitary Eng.	5.
Elec. Eng. (31)	5.	Astronomy (5) Least Squares.	3.	Astronomy (4) Mathematical.	3.
		Architecture (33) Photography.	2.		
		Mathematics ( ) Differ. Equations.	2.		

SUMMER COURSE—Civil Engineering (23) 4 weeks, of 6 days per week. Field work in advanced surveying.

FOURTH YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
Civil Eng. (8) Bridge Design.	5.	Civil Eng. (25) Adv. Bridges *or* Civil Eng. (17) Railways.	5.	Civil Eng. (18) Water Supply.	5.
Civil Eng. (34) Masonry Construction.	3.	Civil Eng. (35) Masonry Structures.	3.	Civil Eng. (37) Contracts and Spec.	3.
Mech. Eng. (46)	5.	Mech. Eng. (47)	3.	Geology (24)	5.
Astronomy (6)	4.	Mech. Eng. (44) Mach. Design.	4.	Civil Eng. (36) Reinforced Concrete.	2.
		Metallurgy (12) Econ. Mineralogy.	2.		

THESIS

---

*The course as outlined above will be entered upon by freshmen, September, 1909.

COURSE IN CIVIL ENGINEERING*

SECOND YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
Math. (41) Calculus.	5.	Math. (42) Calculus.	5.	Math. (43) Calculus.	5.
Physics (2) Mech. and Heat.	4.	Physics (2) Elect. and Magnetism.	4.	Physics (2) Light and Sound.	3.
Civil Eng. (30) Surveying.	5.	Civil Eng. (4) Topog. Drawing.	4.	Civil Eng. (32) R. R. Surveying.	5.
Civil Eng. (31) Field Practice.	1.			Civil Eng. (33) Field Practice.	1.
Eng. Draw. (33) Proj. Drawing.	3.	Eng. Draw. (36) Descriptive Geom.	5.	Eng. Draw. (35) Descriptive Geom.	3.
Military Drill	1.	Military Drill	1.	Military Drill	1.

SUMMER COURSE.—Civil Engineering (22) 4 weeks, of 6 days per week. Field work in surveying.

THIRD YEAR

Mechanics (1) Statics.	5.	Mechanics (2) Strength Materials.	5.	Mechanics (3) Kinetics.	5.
Civil Eng. (3) Topog. Surveying.	4.	Civil Eng. (24) Timber Construction.	4.	Civil Eng. (7) Stresses.	5.
Civil Eng. (16) Roads and Streets.	4.	Civil Eng. (6) Stereotomy.	4.	Civil Eng. (10) Sanitary Eng.	5.
Elec. Eng. (31)	5.	Astronomy (5) Least Squares.	3.	Astronomy (4)	3.
		Architecture (33) Photography.	2.		

SUMMER COURSE.—Civil Engineering (23), 4 weeks of 6 days per week. Field work in advanced surveying.

FOURTH YEAR

Civil Eng. (8) Bridge Design.	5.	Civil Eng. (25) Adv. Bridges *or* Civil Eng. (17) Railways.	5.	Civil Eng. (18) Water Supply.	5.
Civil Eng. (34) Masonry Constr.	3.	Civil Eng. (35) Masonry Struc.	3.	Civil Eng. (10) Sanitary Eng.	5.
Mech. Eng. (46)	5.	Mech. Eng. (47)	3.	Geology (24)	5.
E. E. (6 and 7)	4.	Civil Eng. (14) Cement Testing.	2.		
		Geology (6) Economic.	3.		
		Civil Eng. (36) Reinforced Concrete.	2.		

THESIS

---

*The second, third, and fourth years as outlined above will be given during 1909-10 to present freshmen, sophomores, and juniors respectively.

COURSE IN ELECTRICAL ENGINEERING

FOR OUTLINE OF FIRST YEAR SEE PAGE 17.

SUMMER TERM.—Students are required to take *two* of the following courses in shopwork in the summer term at the close of the first year: Shopwork (4), (7), and (11).

NOTE.—The figure in parenthesis following the name of each study indicates the number of the study in its department; the other figure indicates the number of credit hours.

SECOND YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
‡Drawing (33) Projection Drawing.	3.	‡Drawing (34) Descriptive Geometry.	3.	‡Drawing (35) Adv. Descriptive Geom.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (31) Mechanics, Heat.	5.	Physics (32) Elect'y, Magnetism.	5.	Physics (33) Light, Sound.	5.
Shop (4, 7, or 11)	3.	Shopwork (13) Machine Work.	3.	Physics (5) Laboratory.	4.
*Electives	2 or 3.	*Electives	2 or 3.		
Military Drill	1.	Military Drill	1.	Military Drill	1.

THIRD YEAR

Mechanics (1) Statics.	5.	Mechanics (2) Str'n'th Mat'ls, Kinet.	5.	Mechanics (3) Kinetics, Hydraulics.	5.
Physics (6) Laboratory.	5.	Physics (6) Laboratory.	5.	Mech. Eng. (32) Power Plants.	5.
Physics (4) Elect'y, Magnetism.	3.	Mech. Eng. (37) Mechanism.	4.	Mech. Eng. (28) Laboratory.	2.
Shopwork (14) Machine Work.	3.	Elec. Eng. (30) D. C. Machinery.	4.	Elec. Eng. (30) D. C. Machinery.	4.
Drawing (5) Technical.	3.			Elec. Eng. (15) A. C. Machinery.	2.

Elec. Eng. (20), (21), (22), or (23) is taken at the end of the winter term.

---

‡For 1909-1910.

*Subject to the approval of the professor of Electrical Engineering.

FOURTH YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
Elec. Eng. (16) A. C. Machinery.	3.	Elec. Eng. (17) A. C. Machinery.	2.	Elec. Eng. (25) Transmission.	2.
Elec. Eng. (11) Laboratory.	3.	Elec. Eng. (11) Laboratory.	3.	Elec. Eng. (11) Laboratory.	3.
Mech. Eng. (33) Engines and Boilers.	5.	Elec. Eng. (18) Elec. Design.	3.	Elec. Eng. (19) Designing.	4.
Mech. Eng. (29) Laboratory.	3.	Elec. Eng. (24) Applications.	2.	†Elec. Eng. (26) Railways.	3.
		Mech. Eng. (30) Laboratory.	2.	†Elec. Eng. (27) Telephony.	3.
		Ind. Arts (9) Mach. Design.	2.	†Elec. Eng. (28) Illumination.	3.
**Elective	3-5.	**Elective	3-5.	†Elec. Eng. (29) Wireless Telegraphy.	3.
				**Elective	3-5.

Elec. Eng. (20), (21), (22), or (23) is taken at the end of the winter term.

THESIS

COURSE IN INDUSTRIAL ARTS

FOR OUTLINE OF FIRST YEAR SEE PAGE 17.

SUMMER TERM.—Shopwork Courses (7) 3 and (11) 3 are to be taken in the summer term at the close of the first year.

NOTE.—The figure in parenthesis following the name of each study indicates the number of the study in its department; the other figure indicates the number of credit hours.

SECOND YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
*Drawing (33) Projection Drawing.	3.	*Drawing (34) Descriptive Geometry.	3.	*Drawing (35) Adv. Descriptive Geom.	3.
Physics (2) Mechanics, Heat.	5.	Physics (2) Elect. Magnetism.	5.	Physics (2) Light, Sound.	5.
Mathematics (41) Calculus.	5.	Economics (31) U. S. Industrial Hist.	3.	Economics (32) Commercial Geog.	3.
Shopwork (3) Foundry.	2.	Shopwork (9) Adv. Pattern Making.	3.	Shopwork (4) Chipping and Filing.	3.
Economics (33) Ele. of Pol. Econ.	3.	Economics (33) Ele. of Pol. Econ.	3.	Economics (33) Ele. of Pol. Econ.	3.
Military Drill	1.	Military Drill	1.	Military Drill	1.

---

†Alternative Course.

**Subject to the approval of the professor of Electrical Engineering.

*For 1909-1910.

THIRD YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
Drawing (5) Technical.	3.	Ind. Arts (2) Designing.	3.	Ind. Arts (2) Designing.	3.
Ind. Arts (1) Tools and Machines.	3.	Ind. Arts (1) Tools and Machines.	3.	Ind. Arts (1) Tools and Machines.	3.
Shopwork (13) Machine Work.	3.	Shopwork (14) Machine Work.	3.	Shopwork (15) Machine Work.	3.
Metallurgy (4) Fuels and Iron.	5.	Metallurgy (4) Steel.	2.	Mech. Eng. (32) Power Plants.	5.
Economics (48) Account. and Statistics.	2.	Economics (48) Account. and Statistics.	2.	Economics (48) Account. and Statistics.	2.
		Civil Eng. (27) Timber and Masonry.	3.		

FOURTH YEAR

Shopwork (16) Adv. Mach. Work.	3.	Elective	3.	Shopwork (17) Adv. Mach. Work.	3.
Elec. Eng. (6) Lectures.	2.	Elec. Eng. (6) Lectures.	2.		
Elec. Eng. (7) Laboratory.	2.	Elec. Eng. (7) Laboratory.	2.	Civil Eng. (21) Surveying.	3.
Ind. Arts (3) Shop Equipment.	3.	Ind. Arts (3) Shop Appliances.	3.	Ind. Arts (3) Shop Management.	3.
Ind. Arts (4) Adv. Designing.	3.	Ind. Arts (4) Adv. Designing.	3.	Ind. Arts (4) Adv. Designing.	3.
Mech. Eng. (12) Laboratory.	2.	Mech. Eng. (29) Laboratory.	2.	Mech. Eng. (30) Laboratory.	2.
*Economics (37) Ind. Org'nizat'n, etc.	3.	*Economics (38) Ind. Concen., etc.	3.	*Economics (39) Labor Organ., etc.	3.
†Economics (52) Labor Legislation.	3.	†Economics (39) Labor Organization.	3.	†Economics (53) Lagor Remuneration.	3.

THESIS

---

*For 1909-1910.

†Offered in alternate years.

COURSE IN MANUAL TRAINING

FOR OUTLINE OF FIRST YEAR SEE PAGE 17.

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department; the other figure indicates the number of credit hours.

SECOND YEAR

First Term		Second Term		Third Term	
Drawing (34) Descriptive Geom.	3.	Drawing (35) Adv. Descrip. Geom.	3.	Drawing (35) Shades, Shadows.	3.
Physics (2) Mechanics, Heat.	5.	Physics ( ) Elect'y, Magnetism.	5.	Physics (2) Light, Sound.	5.
Shopwork (7) Woodwork.	3.	Shopwork (9) Adv. Pattern Making.	3.	Shopwork (8) Cabinet Work.	3.
Shopwork (3) Foundry.	3.	Shopwork (11) Forging.	3.	Shopwork (12) Adv. Forging.	3.
Education (1) Elem. Psychology.	3.	Education (1) Elem. Psychology.	3.	Education (1) Elem. Psychology.	3.
Military Drill	1.	Military Drill	1.	Military Drill	1.

THIRD YEAR

Drawing (5) Technical.	3.	Ind. Arts (2) Designing.	3.	Ind. Arts (2) Designing.	3.
Ind. Arts (1) Tools and Machine.	3.	Ind. Arts (1) Tools and Machines.	3.	Ind. Arts (1) Tools and Machines.	3.
Shopwork (4) Chipping, Filing.	3.	Shopwork (13) Machine Work.	3.	Shopwork (14) Machine Work.	3.
History (1) U. S. Political.	3.	History (1) U. S. Political.	3.	History (1) U. S. Political.	3.
*Chemistry (20) Quantitative.	4.	*Chemistry (20) Quantitative.	4.	*Chemistry (20) Quantitative.	4.
*Chemistry (21) Physical.	2.	*Chemistry (21) Physical.	2.	*Chemistry (21) Physical.	2.
*Physics (5) Laboratory.	5.	*Physics (5) Laboratory.	5.	*Physics (5) Laboratory.	5.

FOURTH YEAR

Shopwork (15) Adv. Mach. Work.	3.	Shopwork (16) Adv. Machine Work.	3.	Mech. Eng. (32) Power Plants.	5.
Elec. Eng. (6) Lectures.	2.	Elec. Eng. (6) Lectures.	2.	Mech. Eng. (28) Laboratory.	2.
Elec. Eng. (7) Laboratory.	2.	Elec. Eng. (7) Laboratory.	2.		
Education (5) Science of Educ.	3.	Education (5) Science of Educ.	3.	Education (5) Science of Educ.	3.
Polit. Science (1) Pol. Inst. of U. S.	3.			Electives	5-7.
Electives	2-5.	Electives	5-7.		

THESIS

---

*Students take either Chemistry (20) and (21) or Physics (5).

COURSE IN MECHANICAL ENGINEERING

FOR OUTLINE OF FIRST YEAR SEE PAGE 17.

SUMMER TERM.—Students are required to take *two* of the following courses in shopwork in the summer term at the close of the first year: Shopwork (4), (7), and (11).

NOTE.—The figure in parenthesis following the name of each study indicates the number of the study in its department; the other figure indicates the number of credit hours.

SECOND YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
*Drawing (33) Projections.	3.	*Drawing (34) Descriptive Geom.	3.	*Drawing (35) Shades, Shadows.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (31) Mechanics, Heat.	5.	Physics (32) Elect'y, Magnetism.	5.	Physics (32) Light, Sound.	5.
Required Elec. See Foot-note.†	2-3.	Required Elec. See Foot-note.†	2-3.	Physics (7) Laboratory.	3.
Shopwork (4, 7, 9, or 11)	3.	Shopwork (4, 9, or 11)	3.	Shopwork (13) Machine Work.	3.
Military Drill	1.	Military Drill	1.	Military Drill	1.

THIRD YEAR

Mechanics (1) Statics.	5.	Mechanics (2) Str'n'th Mat'ls, Kinet.	5.	Mechanics (3) Kinetics, Hydraulics.	5.
*Mech. Eng. (12) Laboratory.	2.	Mech. Eng. (3) Mechanism.	5.	Mech. Eng. (3) Mechanism.	2.
Drawing (5) Technical.	3.	Civil Eng. (27) Timber, Masonry.	3.	Architecture (33) Photography.	2.
Metallurgy (4) Fuels and Iron.	5.	Metallurgy (4) Steel.	2.	Civil Eng. (19) Trusses.	5.
Shopwork (14) Machine Work.	3.	Shopwork (15) Adv. Machine Work.	4.	Mech. Eng. (32) Power Plants.	5.
Mathematics (11) Diff. Equations.	1.				

Mech. Eng. (38), (39), (40), or (41) is taken at the end of the winter term.

---

*For 1909-1910 only.

†For students who are deficient in English in the opinion of the Department of English, English (4), or (5) and (6), or (8), or (26) and (27), or (22) and (23) *must* be elected. Other students may elect from the above English, or American History (1), or Chemistry (20), or Economics (30), (31) or (33), or European History (1) and (2), or French (2), or German (4) or (10), or other advanced courses in French or German subject to the approval of the head of the department.

FOURTH YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
Mech. Eng. (33) Engines and Boilers.	5.	Mech. Eng. (34) Thermodynamics.	5.	Mech. Eng. (21) Thesis.	5.
Mech. Eng. (27) Laboratory.	5.	Mech. Eng. (14) Laboratory.	5.	Mech. Eng. (15) Laboratory.	4.
Mech. Eng. (18) Machine Design.	5.	Mech. Eng. (18) Machine Design.	5.	Mech. Eng. (19) Machine Design.	5.
Elec. Eng. (5) Dynamo Mach.	4.	Elec. Eng. (5) Dynamo Mach.	4.	Mech. Eng. (31) Hydraulic Mach.	2.
				†Ind. Arts (5) Shop Appliances.	3.
				†Mech. Eng. (45) Steam Turbines.	3.

THESIS

Mech. Eng. (38), (39), (40), or (41) is taken at the end of the winter term.

---

†Alternative Course.

COURSE IN MINE ENGINEERING

FOR OUTLINE OF FIRST YEAR SEE PAGE 17.

NOTE.—The figure in parenthesis following the name of each study indicates the number of the study in its department; the other figure indicates the number of credit hours.

SECOND YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
*Drawing (33) Projections.	3.	*Drawing (34) Descriptive Geom.	3.	*Drawing (35) Shades, Shadows.	3.
Mathematics (41) Calculus.	5.	Mathematics (42) Calculus.	5.	Mathematics (43) Calculus.	5.
Physics (2) Mechanics, Heat.	3.	Physics (2) Elect'y, Magnetism.	3.	Physics (2) Light, Sound.	3.
Chemistry (20)	5.				
Chemistry (40) Laboratory.	5.	Metallurgy (5) Laboratory.	5.	Metallurgy (5) Laboratory.	5.
Shopwork (7) Woodwork.	2.	Shopwork (11) Forging.	2.	Metallurgy (2) Mineralogy.	3.
Military Drill	1.	Military Drill	1.	Military Drill	1.

THIRD YEAR

Mechanics (1) Statics.	5.	Mechanics (2) Str'n'th Mat'ls, Kinet.	5.	Mechanics (3) Kinetics, Hydraulics.	5.
Metallurgy (4) Fuels and Iron.	5.	Metallurgy (4) General.	5.	Metallurgy (3) Deter. Mineralogy.	5.
Mine Eng. (4) Mine Surveying.	5.	Metallurgy (6) Assaying.	5.	Civil Eng. (19) Trusses.	5.
Metallurgy (5)	3.	Mine Eng. (7) Surveying.	1.	Advanced Met. Lab. ( )	3.
		Met. Problems	2.		

---

*For 1909-1910 only.

FOURTH YEAR

First Term		Second Term		Third Term	
Mine Eng. (5) Mine Engineering.	5.	Mine Eng. (5) Mine Engineering.	5.	Mine Eng. (5) Mine Engineering.	5.
Geology (2) General.	5.	Geology (6) Economic.	3.	Mech. Eng. (36) Laboratory.	5.
Metallurgy (8) Ore Dressing.	2.	Metallurgy (7) Metal Construction.	3.	Mine Eng. (6) Plans and Spec.	5.
Elec. Eng. (6) Lectures.	2.	Elec. Eng. (6) Lectures.	2.	Architecture (33) Photography.	2.
Elec. Eng. (7) Laboratory.	2.	Elec. Eng. (7) Laboratory.	2.		
		Geology (7) Petrography.	2.		

THESIS

TWO-YEAR COURSES

SHORT COURSE IN CLAY-WORKING

FIRST YEAR

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department; the other figure indicates the number of credit hours.

First Term		Second Term		Third Term	
Chemistry (3) Inorganic.	4.	Chemistry (3) Inorganic.	4.	Chemistry (45) Quantitative.	4.
Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.
Mathematics (3) Plane Geom.	5.	Mathematics (13) Space Geom.	5.	Mathematics (14) Trigonometry.	5.
Drawing (2) Lettering.	3.	Drawing (38) Projections.	3.	Drawing (39) Drafting.	3.
Military Drill	1.	Military Drill	1.	Military Drill	1.
Gymnasium	1.	Gymnasium	1.	Gymnasium	1.

Summer Term.—Students are required to take Shopwork (7) and (11) in the summer term at the end of the first year. But they may be excused from this where they are able to obtain positions in some ceramic establishment for the summer; and on presentation of a satisfactory certificate, endorsed by the head of the department, work in a ceramic factory during the summer may be counted as equivalent to the summer shop course.

SECOND YEAR

Ceramics (1) Laboratory.	5.	Ceramics (2) Laboratory.	5.	Ceramics (19) Laboratory.	5.
Ceramics (4) Raw Materials.	5.	Ceramics (5) Preparation and Mfg.	5.	Ceramics (6) Drying and Burning.	5.
Physics (1) Elementary.	5.	Physics (1) Elementary.	5.	Ceramics (27)	3.
Ceramics (20) Mfg. Bodies.	2.	Ceramics (21) Mfg. Glazes.	2.	Ceramics (23) Mfg. Colors.	4.
Military Drill	1.	Military Drill	1.	Military Drill	1.

SHORT COURSE IN INDUSTRIAL ARTS

FIRST YEAR

Note.—The figure in parenthesis following the name of each study indicates the number of the study in its department; the other figure indicates the number of credit hours.

First Term		Second Term		Third Term	
Drawing (24) Freehand.	1.	Drawing (25) Freehand.	1.	Drawing (26) Freehand.	1.
Drawing (2) Lettering.	3.	Drawing (38) Projections.	3.	Drawing (39) Drafting.	3.
Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.
Mathematics (3) Plane Geometry.	5.	Mathematics (13) Space Geometry.	5.	Mathematics (14) Trigonometry.	5.
Shopwork (7) Pattern Making.	3.	Shopwork (9) Adv. Pattern Making.	3.	Shopwork (11) Forging.	3.
Military Drill	1.	Military Drill	1.	Military Drill	1.
Gymnasium	1.	Gymnasium	1.	Gymnasium	1.

SECOND YEAR

Ind. Arts (8) Machine Drawing.	3.	Drawing (34) Descriptive Geom.	3.	Drawing (35) Shades, Shadows.	3.
Ind. Arts (1) Tools, Machines.	3.	Ind. Arts (1) Tools, Machines.	3.	Ind. Arts (1) Tools, Machines.	3.
Physics (1) Elementary.	5.	Physics (1) Elementary.	5.	Geology (1) Phys. Geography.	5.
Shopwork (4) Chipping, Filing.	3.	Shopwork (13) Machine Work.	3.	Shopwork (14) Adv. Machine Work.	3.
Shopwork (3) Foundry.	2.	Ind. Arts (2) Designing.	3.	Ind. Arts (2) Designing.	3.
Military Drill	1.	Military Drill	1.	Military Drill	1.

SHORT COURSE IN MINING

NOTE.—The figure in parenthesis following the name of each study indicates the number of the study in its department; the other figure indicates the number of credit hours.

FIRST YEAR

FIRST TERM		SECOND TERM		THIRD TERM	
Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.	Mathematics (2) Algebra.	5.
Mathematics (3) Geometry.	5.	Mathematics (13) Space Geometry.	5.	Mathematics (14) Trigonometry.	5.
Physics (1) Elementary.	5.	Physics (1) Elementary.	5.	Geology (1) Phys. Geography.	5.
Military Drill	1.	Military Drill	1.	Military Drill	1.
Gymnasium	1.	Gymnasium	1.	Gymnasium	1.

SECOND YEAR

Drawing (2) Lettering.	3.	Drawing (38) Projections.	3.	Drawing (39) Drafting.	3.
Drawing (27) Freehand.	2.	Geology (4) Elementary.	5.	Shopwork (11) Forging.	3.
Chemistry (3) Inorganic.	4.	Chemistry (3) Inorganic.	4.	Metallurgy (9) Mineral Chemistry.	5.
Mine Eng. (1) Mine Surveying.	5.	Mine Eng. (2) Ventilat. Haulage.	5.	Mine Eng. (3) Mine Operating.	5.
		Mine Eng. (7) Surveying.	1.		
Military Drill	1.	Military Drill	1.	Military Drill	1.

DEPARTMENTS OF INSTRUCTION

AMERICAN HISTORY AND POLITICAL SCIENCE

(Office, University Hall, Room 207)

PROFESSORS KNIGHT, SPENCER, ASSISTANT PROFESSOR TANNER, AND MR. DYKSTRA

HISTORY

1. POLITICAL HISTORY OF THE UNITED STATES. Three credit hours. Text-books and prescribed reading. Thwaites' The Colonies, Hart's Formation of the Union, Wilson's Division and Re-Union. Manual Training, third year, first, second and third terms, *M., W., F.,* 8 *or* 9. Mr. DYKSTRA.

POLITICAL SCIENCE

1. CONSTITUTIONAL GOVERNMENT. Three credit hours. Manual Training, fourth year, first term, *M., W., F., at* 9. Prerequisite, American History 1. Professor SPENCER.

Lectures and recitations. This is the first term's work of a course running through the entire year and is a study of the origin and nature of the political institutions of the United States, and an analysis of the form and powers of the government.

ARCHITECTURE

(Office, Room 22, Brown Hall)

PROFESSOR BRADFORD, ASSOCIATE PROFESSOR CHUBB,. MR. HASKETT

4. SPECIFICATIONS. Two credit hours. Architecture, fourth year, second term. *M.,* 1 *to* 5, and assigned work. Prerequisite, Architecture 18. Professor BRADFORD.

Lectures and practice in preparing specifications for architectural structures.

5. DECORATION AND ORNAMENT. Five credit hours. Architecture, third year, first term. *Tu., Th., at* 11; *M. F.,* 9 *to* 12. Prerequisite, Drawing 37 and Architecture 14. Associate Professor CHUBB.

Lectures on the different styles of carved ornament and decorative color.

9. HISTORY OF ARCHITECTURE. Three credit hours. Architecture, second year, first term. *M., W., F., at* 9. Professor BRADFORD.

Lectures illustrated by lantern slides.

10. Continuation of 9. Architecture, second year, second term. *M., W., F., at* 9. Professor BRADFORD.

11. Continuation of 10. Architecture, second year, third term. *M., W. F., at* 9. Professor BRADFORD.

12. THE ORDERS. Two credit hours. Architecture, second year, first term. *W., Th.,* 1 *to* 3. Concurrent, Drawing 33 and Architecture 9. Associate Professor CHUBB.

Drawing details of orders, with the special object of impressing upon the student's mind the architectural characteristics considered.

13. ORDER PROBLEMS. Three credit hours. Architecture, second year, second term. *W., Th., F.,* 1 *to* 4. Prerequisite, Architecture 12. Associate Professor CHUBB.

Course in architectural designing incorporating the different Architectural Orders.

14. Continuation of 13. Three credit hours. Architecture, second year, third term. *W., Th., F.,* 1 *to* 4. Concurrent, Architecture 11. Associate Professor CHUBB.

15. RESIDENCE ARCHITECTURE. Four credit hours. Lectures and practice. Architecture, third year, first term. *M., Tu., W.,* 1 *to* 4. Prerequisite, Architecture 14, and Drawing 37. Professor BRADFORD.

17. SCHOOL ARCHITECTURE. Four credit hours. Architecture, third year, third term. *M., Tu., W.,* 1 *to* 4. Prerequisite, Architecture 23. Associate Professor CHUBB.

18. PUBLIC BUILDINGS. Four credit hours. Architecture, fourth year, first term. *W., Th., F.,* 1 *to* 4. Prerequisite, Architecure 17. Professor BRADFORD, Associate Professor CHUBB.

19. ECCLESIASTICAL ARCHITECTURE. Four credit hours. Architecture, fourth year, third term. *M., Tu.,* 1 *to* 4. Prerequisite, Architecture 21. Professor BRADFORD.

20. THESIS. Five credit hours. Architecture, fourth year, third term. *Tu., Th.,* 9 *to* 12, *F.,* 1 *to* 5.

Original design to be accompanied with written description, specifications, and estimate.

21. ARCHITECTURE OF TALL SKELETON-CONSTRUCTED BUILDINGS. Four credit hours. Architecture, fourth year, second term. *M., at*

10, *Tu., Th.,* 9 *to* 11, *F.,* 1 *to* 5. Prerequisite, Architecture 18. Professor BRADFORD, Associate Professor CHUBB.

22. PRINCIPLES OF ARCHITECTURAL COMPOSITION. Two credit hours. Architecture, third year, first term. *Tu., Th., at* 9. Concurrent, Architecture 5. Associate Professor CHUBB.

23. DESIGNING. Modern apartment houses. Four credit hours. Architecture, third year, second term. *Tu.,* at 11, *M.,* 1 *to* 5, *S.,* 8 *to* 12. Prerequisite, Architecture 15. Associate Professor CHUBB.

24. STRUCTURAL DETAILS. Five credit hours. Architecture, third year, third term. *Tu., Th., at* 10, *M., F.,* 8 *to* 11. Prerequisite, Architecture 15. Professor BRADFORD.

25. SANITARY PLUMBING. Two credit hours. Architecture, fourth year, first term. *M., W., at* 8. Professor BRADFORD.

Lectures on the principles of sanitary plumbing.

26. ARCHITECTURAL PERSPECTIVE. Five credit hours. Architecture, second year, third term. *M., F., at* 10; *Tu., Th.,* 9 *to* 12. Associate Professor CHUBB.

27. ARCHITECTURAL STEREOTOMY. Four credit hours. Architecture, third year, second term. *W., at* 11, *M. F.,* 9 *to* 12. Prerequisite, Drawing 36. Professor BRADFORD.

Lectures and practice. Arches, vaults, domes, wing walls, stair ramps, etc.

28. ESTIMATING. Two credit hours. Course in Architecture, fourth year, third term. *W., at* 11, *F.,* 10 *to* 12. Professor BRADFORD.

Lectures and practice in preparing the estimated cost of buildings.

29. PROFESSIONAL PRACTICE. Two credit hours. Architecture, fourth year, third term. *Tu., Th., at* 8. Professor BRADFORD.

Lectures on relations of architect and owner, architect and contractor, duties of supervisor of erection, contracts, office practice, etc.

30. MONUMENTAL DESIGN. Three credit hours. Architecture, fourth year, first term. *M., Tu.,* 1 *to* 4. Prerequisite, Architecture 17. Professor BRADFORD, Associate Professor CHUBB.

31. SUMMER WORK. The equivalent of four weeks of work in an architect's office, eight hours a day. Summer vacation at end of sophomore or junior year.

32. SUMMER WORK. Working up a problem in design, assigned by the department, or a report on summer travel. Summer vacation at end of sophomore or junior year.

33. PHOTOGRAPHY. Two credit hours. Architecture and Ceramic Engineering, third year, first term. *Th., F.,* 1 *to* 3. Civil

Engineering, third year, second term. *M., Tu.,* 1 *to* 3; *Th., F.,* 1 *to* 3. Mechanical Engineering, third year, third term. Mine Engineering, fourth year, third term. *M., Tu.,* 1 *to* 3; *Th., F.,* 1 *to* 3. Prerequisite, Chemistry 7. Mr. HASKETT.

*34. SHADES AND SHADOWS. Two credit hours. Architecture, second year, first term. Associate Professor CHUBB.

*35. WORKING DRAWINGS. Three credit hours. Architecture, third year, second term. Professor BRADFORD.

ASTRONOMY

(Office, Emerson McMillin Observatory)

PROFESSOR H. C. LORD, ASSISTANT PROFESSOR MANSON

4. ASTRONOMY, GEODESY, AND LEAST SQUARES. Three credit hours. Civil Engineering, third year, third term. Lectures, *M., Tu., F., at* 10, *or M., W., F., at* 11. Laboratory hours arranged with the students individually Prerequisite, Mathematics 43 and Physics 2. Professor LORD, Assistant Professor MANSON.

Lectures on practical astronomy, supplemented by practice with the instruments of the Emerson McMillin Observatory.

5. Continuation of 4. Three credit hours. Civil Engineering, third year, second term. Lectures, *M., Tu., F., at* 10, *or M., W., F., at* 11 Professor LORD, Assistant Professor MANSON.

*6. Continuation of 5. Laboratory work. Four credit hours. Civil Engineering, fourth year, first term. Professor LORD, Assistant Professor MANSON.

---

*Not given in 1909-1910.

CERAMIC ENGINEERING

(Office, Room 119, School of Mines Building)

PROFESSOR ORTON, ASSOCIATE PROFESSOR PURDY, MR. WORCESTER

1. CERAMIC CHEMISTRY. Five credit hours. Ceramic Engineering and Short Clay-working, second year, first term. *M., Tu., W.,* 1 *to* 4. Prerequisite, Chemistry 12 or 45. Associate Professor PURDY.

Quantitative analysis of salts, lime stone, and simple minerals.

2. Continuation of 1. Five credit hours. Ceramic Engineering and Short Clay-working, second year, second term. *M., Tu., W.,* 1 *to* 4. Associate Professor PURDY.

---

*Not given in 1909-1910.

Quantitative analysis of clays and similar minerals; first, samples of known composition; later, unknown materials.

3. Continuation of 2. Three credit hours. Ceramic Engineering, second year, third term. *M., Tu., W.,* 1 *to* 4. Associate Professor PURDY.

Completion of the ultimate analysis of clays; the proximate or "Rational" analysis of clays and pottery bodies.

4. CLAY MANUFACTURE. Five credit hours. Ceramic Engineering, third year, first term; Short Clay-working, second year, first term. *M., Tu., W., Th., F., at* 8. Concurrent, Ceramics 1. Professor ORTON.

The origin, composition, and properties and occurrence of clays and other minerals employed in the clay, glass, and cement industries.

5. Continuation of 4. Five credit hours. Ceramic Engineering, third year; Short Clay-working, second year, second term. *M., Tu., W., Th., F., at* 9. Professor ORTON.

General principles of the manufacture of clay wares, including the selection and winning of the materials, their preparation and manufacture.

6. Continuation of 5. Five credit hours. Ceramic Engineering, third year; Short Clay-working, second year, third term. *M., Tu., W., Th., F., at* 9. Professor ORTON.

The drying and burning of claywares.

9. LABORATORY WORK IN CERAMICS. Five credit hours. Ceramic Engineering, fourth year, first term. *M., Th., F.,* 1 *to* 4. Prerequisite, Ceramics 3 and 6. Professor ORTON, Mr. WORCESTER.

Practice in clay testing and measurement of the physical properties of clays; the production of bodies made from single clays, from the blending of two or more natural clays, and of clays with minerals other than clays. In each case the bodies made are burnt and tested.

10. Continuation of 9. Five credit hours. Ceramic Engineering, fourth year, second term. *M., W., F.,* 1 *to* 4. Professor ORTON, Mr. WORCESTER.

The production of glasses and glazes, beginning with the soft raw-lead glazes, the fritted lead-boracic-acid glazes, and the hard-fire leadless porcelain glazes. In each case the glazes are made for use on some definite body.

11. Continuation of 10. Five credit hours. Alternative with Ceramics 12. Ceramic Engineering, four year, third term. *M. W., F.,* 1 *to* 4. Professor ORTON, Mr. WORCESTER.

Practice in the use of the coloring and opacifying oxides in glazes, and in the production of colors and body stains for the decoration of claywares.

12. CEMENT MANUFACTURE. Five credit hours. Alternative with Ceramics 11. Ceramic Engineering, fourth year, third term. *M., Tu., W., Th., F., at* 8. Prerequisite, Ceramics 3 and 6. Associate Professor PURDY.

The theory of hydraulicity, the compounding, manufacture, and testing of natural and Portland cements and hydraulic silicates.

15. THESIS.. *M., F.,* 9 *to* 12, *Th.,* 10 *to* 12.

18. CEMENT MANUFACTURE. Five credit hours. Elective course. Laboratory. Time to be arranged. Prerequisite, Ceramics 12. Associate Professor PURDY.

Training in the analysis of cement materials by the methods in technical use; in the preparation of minerals for cement; in the burning of cement; in the testing of the products, and in the investigation of the general problems of the cement manufacture.

19. STOICHIOMETRY. Five credit hours. Short Clay-working, second year, third term. *M., Tu., Th., F., at* 10, and *Tu., at* 11. Prerequisite, Ceramics 1 and 2. Associate Professor PURDY.

Practice in the calculations on bodies and glazes and those pertaining to the combustion of fuel for driers and kilns.

20. LABORATORY WORK IN CERAMICS. Two credit hours. Short Clay-working, second year, first term. *Th., F.,* 1 *to* 4. Prerequisite, Chemistry 45. Concurrent, Ceramics 1. Professor ORTON, Mr WORCESTER.

Testing of clays and minerals employed in clay manufacture.

21. LABORATORY WORK IN CERAMCS. Two credit hours. Short Clay-working, second year, second term. *Th., F.,* 1 *to* 4. Prerequisite, Ceramics 20. Professor ORTON, Mr. WORCESTER.

Compounding of artificial clay bodies and the blending of natural clays.

23. LABORATORY WORK IN CERAMICS. Four credit hours. Short Clay-working, second year, third term. *M., W., F.,* 1 *to* 4. Prerequisite, Ceramics 2 and 5. Professor ORTON, Mr. WORCESTER.

The production of glazes of the types commonly used in the pottery and allied industries. Practice will be given in fitting glazes to some definite body.

24. CERAMIC CALCULATIONS. Two credit hours. Ceramic Engineering, second year, third term. *Tu., Th., at* 10. Prerequisite, Ceramics 2. Concurrent, Ceramics 3. Associate Professor PURDY.

Elementary calculations in the calculation of the composition of silicate mixtures, from formulæ and from percents, the results of the rational analysis of clay bodies, and simple glaze formulæ.

25. CLASSIFICATION AND IDENTIFICATION OF CLAYS. Three credit hours. Ceramic Engineering, third year, second term. *Tu.*, 1 *to* 4, *S.*, 8 *to* 12. Prerequisite, Ceramics 4. Concurrent, Ceramics 5. Professor ORTON, Mr. WORCESTER.

Studies on hand specimens of typical clays and clay forming minerals, and their identification by simple tests.

26. PHYSICAL AND CHEMICAL MEASUREMENTS OF CLAYS. Five credit hours. Ceramics, third year, third term. *W.*, *Th.*, *F.*, 1 *to* 4. Prerequisite, Chemistry 30, Physics 2 and 3, and Ceramics 5. Associate Professor PURDY.

The application to ceramics of the principles of physical chemistry, especially the phase rule, the studies of eutectics, melting point, pyrometry, calibration of instruments, etc.

27. CLAY MANUFACTURE. Three credit hours. Ceramic Engineering, third year, third term. Short Clay-working, second year, third term. *M.*, *W.*, *F.*, *at* 11. Prerequisite, Ceramics 2 and 5. Professor ORTON.

The decoration of claywares by glazing and coloring. This course deals with decoration from the technological side only, not touching upon the artistic.

CHEMISTRY

(Office, Chemistry Hall)

PROFESSOR MCPHERSON, EMERITUS PROFESSOR NORTON, PROFESSORS HENDERSON, FOULK, ASSOCIATE PROFESSOR EVANS, ASSISTANT PROFESSOR WITHROW, MR. VOGT, MR. MORRIS, MR. LUCAS, MR. SALE, AND DEPARTMENT FELLOWS

3. ELEMENTARY CHEMISTRY. Four credit hours. First and second terms. One lecture, one quiz, six hours laboratory work weekly. Lectures, *M.*, *at* 10; quiz, *Th.*, *at* 8 *or* 10. Laboratory, *M.*, *Tu.*, 1 *to* 4, *or* *Th.*, *F.*, 1 *to* 4. Associate Professor EVANS, Assistant Professor WITHROW, Mr. VOGT, Mr. MORRIS, and department fellows.

This course is distinctly elementary in character, and is arranged for students in short courses only. No credit is allowed for it in the regular four year courses.

7. ELEMENTARY CHEMISTRY. Four credit hours. First and second terms. One lecture, one quiz, six hours laboratory work

weekly. Lecture, *M., at* 8 *or* 3.; quiz, to be arranged. Laboratory, *M., F.,* 9 *to* 12; *Tu., Th.,* 9 *to* 12; *M., Tu.,* 1 *to* 4; *Th., F.,* 1 *to* 4; *W.,* 1 *to* 4, *S.,* 8 *to* 11. Associate Professor EVANS, Mr. VOGT, Mr. MORRIS, and department fellows.

This course is arranged for students who have not presented chemistry as an entrance requirement. Students taking this course will follow with Course 12, third term.

44. GENERAL CHEMISTRY. Four credit hours. First and second terms. One lecture, one quiz, and six hours laboratory work weekly. Lecture, *W., at* 9; quiz, to be arranged. Laboratory, *M., F.,* 9 *to* 12; *Tu., Th.,* 9 *to* 12; *M., Tu.,* 1 *to* 4; *Th., F.,* 1 *to* 4; *W.,* 1 *to* 4, *S.,* 8 *to* 11. Professor MCPHERSON, Professor HENDERSON, Associate Professor EVANS, Mr. VOGT, Mr. MORRIS, and department fellows.

This course is arranged for students who have had an acceptable course in elementary chemistry in a secondary school. Students taking this course will follow with Course 12, the third term.

45. QUALITATIVE ANALYSIS. Four credit hours. Third term. One lecture, one quiz, six hours laboratory work weekly. Prerequisite, Chemistry 3. Time same as Chemistry 3. Associate Professor EVANS, Assistant Professor WITHROW, Mr. VOGT, Mr. MORRIS, and department fellows.

This is a general elementary course in qualitative analysis, and is arranged for students in short courses only.

12. QUALITATIVE ANALYSIS. Four credit hours. Third term. One lecture, one quiz, six hours laboratory work weekly. Prerequisite, Chemistry 7 or 44. Lecture, *M., at* 8 *or* 3, *or W., at* 9; quiz and laboratory at same time as Chemistry 7 or 44. Associate Professor EVANS, Assistant Professor WITHROW, Mr. VOGT, Mr. MORRIS, and department fellows.

This is a general introductory course in qualitative analysis.

21. ADVANCED GENERAL CHEMISTRY. Two credit hours. First, second, and third terms. Two lectures weekly. *Tu., Th., at* 11. Prerequisite, Chemistry 7 or 44. Professor HENDERSON.

This course consists of reviews and extends the work in general chemistry.

20. QUANTITATIVE ANALYSIS. Four credit hours. First, second, and third terms. One lecture, nine hours laboratory work weekly. Lecture, *M., at* 1. Laboratory open forenoons and afternoons. Prerequisite, Chemistry 12 or its equivalent. Professor FOULK, Mr. SALE.

First principles of gravimetric and volumetric analysis. This course must be accompanied by Chemistry 40, except by special permission of the instructor. It is also desirable that it should be accompanied by Chemistry 21.

40. CHEMICAL PROBLEMS. One credit hour. First and second terms. *F., at* 11. Professor FOULK.

Extended practice in the solution of chemical problems pertaining to analytical chemistry. This course is arranged to accompany Chemistry 20.

46. ORGANIC CHEMISTRY. Two credit hours. First, second, and third terms. Two lectures weekly. *Tu., Th., at* 10. Prerequisite, courses 20 and 21, except by special permission of the instructor. Professor MCPHERSON.

General course in organic chemistry. Whenever possible, this course should be accompanied by Chemistry 47.

47. ORGANIC CHEMISTRY. Two or three credit hours. First, second, and third terms. Six or nine hours laboratory work weekly. Laboratory open afternoons. Professor MCPHERSON, Mr. LUCAS.

Preparation of typical organic compounds. This course must be accompanied or preceded by course 46.

48. QUALITATIVE ANALYSIS. Advanced course. Three to five credit hours. Third term. One lecture, six to twelve hours laboratory work weekly. Time to be arranged. Prerequisite, Chemistry 20. Professor FOULK.

Extended work in general qualitative analysis; practice with insoluble substances; use of the spectroscope, etc.

15. SANITARY ANALYSIS. Four credit hours. Third term. Two lectures, four hours laboratory work weekly. Lectures, *M., F., at* 10. Laboratory open forenoons and afternoons. Prerequisite, Chemistry 20. Professor FOULK.

A study of the methods of sanitary water analysis and the interpretation of results.

30. PHYSICAL CHEMISTRY. Three credit hours. First and second terms. *M., W., F., at* 8. Prerequisite, Chemistry 20, 21; also course 46, except by special permission of the instructor. Ceramic Engineering, third year, second term. *M., W., F., at* 8. Professor HENDERSON.

A general course in the theory of chemistry.

32. INDUSTRIAL CHEMISTRY. Four credit hours. First and second terms. Two lectures, six hours laboratory work weekly. *Tu., Th., at* 8. Laboratory, *W., Th.,* 1 *to* 4. Prerequisite, Chemistry 20, 21, 46, 47. Assistant Professor WITHROW.

Industrial applications of chemistry.

71. TECHNICAL ANALYSIS. Four credit hours. Third term. One lecture, nine hours laboratory work weekly. Lecture, *Tu., at* 11. Laboratory open afternoons. Prerequisite, course 20. Professor FOULK.

The chemical examination of various commercial products.

17. INORGANIC PREPARATIONS. Two or three credit hours. First or second term. Six to nine hours laboratory work weekly. Time to be arranged. Prerequisite, courses 20, 21. Professor HENDERSON.

Practice in preparing some typical inorganic substances in good physical condition and high degree of purity.

35. RARE ELEMENTS. Three credit hours. Third term. Three lectures weekly. *M., W., F., at* 8. Prerequisite, courses 20 and 21. Professor HENDERSON.

A general study of the less familiar elements, including their industrial applications.

50. PHYSICAL CHEMISTRY. Three credit hours. Third term. Nine hours laboratory work weekly. Time to be arranged. Prerequisite, course 30. Professor HENDERSON.

A laboratory course in selected physical-chemical exercises.

77. THE READING OF CHEMICAL LITERATURE. Two credit hours. First term. Time to be arranged. Prerequisite, German 1. Professor FOULK.

The main object of this course is to afford practice in the rapid reading of German chemical literature, the selections being made with special reference to the technical terms of the science.

78. INDUSTRIAL INSPECTION TRIPS. A four to six days excursion taken at a suitable time in connection with Chemistry 32 for the inspection of industrial chemical processes in actual operation. The entire expense varies from $15 to $30. A satisfactory written report on the work inspected is required.

79. WRITTEN REPORTS. A course of assigned reading upon some industrial chemical process and a written report on same. This course is a substitute for course 78, but the substitution is only allowed upon presentation of reasons satisfactory to the head of the department.

80. THESIS. Three credit hours minimum. Second and third terms.

CIVIL ENGINEERING

(Office, Brown Hall, Room 33)

PROFESSOR SHERMAN, PROFESSOR ENO, PROFESSOR MORRIS, ASSISTANT PROFESSOR SCHLAFLY, ASSISTANT PROFESSOR CHAMBERLIN, MR. WARD, MR. SHOEMAKER

3. TOPOGRAPHIC SURVEYING. Four credit hours. Lectures, field work, and drawing. Johnson's Surveying used for reference. Civil Engineering, third year, first term. *M., F., at* 10, *M., Tu., W.,* 1 *to* 4, *or Tu., Th., at* 11, *Th., F.,* 1 *to* 4, *S.,* 8 *to* 11. Prerequisite, Civil Engineering 32 and 22. Assistant Professor SCHAFLY, Asistant Professor CHAMBERLIN.

4. TOPOGRAPHICAL DRAWING. Four credit hours. Platting, pen and tinted work. Reed's Topographic Drawing and Sketching. Civil Engineering, second year, second term. *M., Tu., W.,* 1 *to* 4, *or Th., F.,* 1 *to* 4, *S.,* 8 *to* 11. Prerequisite, Drawing 26 and 32. Professor SHERMAN, Professor ENO.

6. STEREOTOMY. Four credit hours. Recitations, lectures, and drawing. Warren's Stereotomy. Civil Engineering, third year, second term. *M., F., at* 10, *S.,* 8 *to* 12, *or Tu., Th., at* 11, *S.,* 8 *to* 12. Prerequisite, Drawing 36. Assistant Professor SCHAFLY, Assistant Professor CHAMBERLIN.

7. BRIDGE STRESSES. Five credit hours. Recitations and lectures. Heller's Stresses in Structures. Civil Engineering, third year, third term. *M., Tu., W., Th., F.,* 8 *or* 9. Prerequisite, Mechanics 2. Professor MORRIS.

8. BRIDGE DESIGNING. Five credit hours. Lectures and drawing. Morris's Notes and Johnson's Modern Framed Structures used for reference. Civil Engineering, fourth year, first term. *M., Tu., W., Th., F., at* 8 *or* 9. Prerequisite, Civil Engineering 7. Professor MORRIS.

10. SANITARY ENGINEERING. Five credit hours. Recitations and lectures. Folwell's Sewerage. Civil Engineering, third and fourth years, third term. *M., Tu., W., Th., F., at* 9, 1, *or* 2. Prerequisite, Civil Engineering 34. Professor ENO.

14. CIVIL ENGINEERING LABORATORY. Two credit hours. Civil Engineering, fourth year, second term. *M.,* 1 *to* 4, *Tu., at* 1; *Tu.,* 1 *to* 4, *W., at* 1; *W.,* 1 *to* 4, *Th., at* 1; *Th.,* 1 *to* 4, *F., at* 10. Prerequisite, Civil Engineering 34. Professor ENO, Mr. WARD.

Cement testing and adjustment of instruments.

16. HIGHWAYS. Four credit hours. Recitations and lectures. Baker's Roads and Pavements. Civil Engineering, third year, first term. *M., Tu., Th., F., at* 8 *or* 10. Prerequisite, Civil Engineering 32. Professor ENO.

17. RAILWAY LOCATION. Five credit hours. Recitations and lectures. Wellington's Economic Theory of Railway Location. Option, Civil Engineering, fourth year, second term. *M., Tu., W., Th., F., at* 9. Prerequisite, Civil Engineering 34. Professor SHERMAN.

18. WATER SUPPLY. Five credit hours. Recitations and lectures. Turneaure and Russell's Public Water Supplies. Civil Engineering, fourth year, third term. *M., Tu., W., Th., F., at* 8. Prerequisite, Civil Engineering 34. Professor ENO.

19. TRUSSES. Five credit hours. Lectures and drawing. Ceramic Engineering, fourth year, second term. *M., Tu., W., Th., F., at* 9. Architecture, Mining, and Mechanical Engineering, third year, third term. *M., Tu., Th., F., at* 10, *W., at* 2 *or M., Tu., W., Th., F., at* 11. Prerequisite, Mechanics 2. Professor SHERMAN, Professor MORRIS.

21. SURVEYING. Three credit hours. Architecture and Industrial Arts, fourth year, third term. *M., W., F., at* 9. Prerequisite, Drawing 32 and Mathematics 14 or 32. Assistant Professor CHAMBERLIN, Mr. WARD.

Recitations, lectures, and field work.

22. SUMMER FIELD WORK. At conclusion of second year of course in Civil Engineering. Prerequisite, Civil Engineering 32 and 4. Professor SHERMAN, Professor ENO, Assistant Professor SCHLAFLY, Assistant Professor CHAMBERLIN, Mr. WARD.

The students are given a thorough drill in elementary surveying. The course begins the Friday before Commencement Day, and continues four weeks of six days per week, ten hours per day.

23. ADVANCED SUMMER FIELD WORK. Similar to 22. At conclusion of third year of course in Civil Engineering. Prerequisite, Civil Engineering 3, 22, and 24.

24. TIMBER CONSTRUCTION. Four credit hours. Civil Engineering, third year, second term. *M., Tu., W.,* 1 *to* 5 *or W., Th., F.,* 1 *to* 5. Prerequisite, Drawing 35 and Mechanics 1. Assistant Professor SCHLAFLY, Assistant Professor CHAMBERLIN.

25. ADVANCED BRIDGE WORK. Five credit hours. Draw-spans, continuous girders, steel arches, etc. Option, Civil Engineering,

fourth year, second term. *M., Tu., W., Th., F., at* 8. Prerequisite, Civil Engineering 8. Professor MORRIS.

27. TIMBER AND MASONRY. Three credit hours. Industrial Arts and Mechanical Engineering, third year, last three-fifths of second term. *M., Tu., W., Th., F., at* 9. Concurrent, Industrial Arts 4 or Mechanics 2. Professor ENO, Assistant Professor SCHLAFLY.

Lectures and recitations. Use of stone, brick, lime, cement, timber, etc., in engineering structures.

28. STEEL CONSTRUCTION. Five credit hours. Architecture, fourth year, second term. *M., Tu., W., Th., F., at* 11. Prerequisite, Civil Engineering 19. Professor MORRIS.

Steel skeleton construction for tall buildings.

29. CEMENT TESTING. Three credit hours. Architecture, fourth year, second term. *Tu., W.,* 1 *to* 4. Prerequisite, Civil Engineering 34. Professor ENO, Mr. WARD.

30. SURVEYING. Five credit hours. Civil Engineering, second year, first term. *M., Tu., W., Th., F., at* 8 *or* 11. Prerequisite, Mathematics 14 or 32. Professors SHERMAN, ENO, Assistant Professors SCHLAFLY, CHAMBERLIN, Mr. WARD.

Recitations and lectures. Use and adjustment of instruments; farm, city, and hydrographic surveying, and leveling.

31. FIELD PRACTICE IN SURVEYING. One credit hour. Civil Engineering, second year, first term. Concurrent, Civil Engineering 30.

32. RAILROAD SURVEYING. Five credit hours. Civil Engineering, second year, third term. *M., Tu., W., Th., F., at* 8 *or* 11. Prerequisite, Civil Engineering 30 and 31. Professors SHERMAN, ENO, Assistant Professors SCHLAFLY, CHAMBERLIN, Mr. WARD.

Simple and compound curves, spirals, frogs and switches, and earthwork.

33. FIELD PRACTICE IN RAILROAD SURVEYING. One credit hour. Civil Engineering, second year, third term. Concurrent Civil Engineering 32.

34. MASONRY CONSTRUCTION. Three credit hours. Civil Engineering and Architecture, fourth year, first term. *M., W., F., at* 8 *or* 9. Prerequisite, Mechanics 2. Professor SHERMAN.

Recitations and lectures. Baker's Masonry Construction and Taylor and Thompson's Concrete for texts.

35. MASONRY STRUCTURES. Three credit hours. Civil Engineering, fourth year, second term. *M., Tu., Th., at* 10. Prerequisite, Civil Engineering 34. Professor SHERMAN.

Lectures and recitations, and drawing, designing of masonry structures. Baker's Masonry Construction, and various standard plans used for reference.

36. REINFORCED CONCRETE. Two credit hours. Civil Engineering, fourth year, third term. Prerequisite, Mechanics 2 and Civil Engineering 35.

Theory and practice. Reinforced concrete design.

37. CONTRACTS AND SPECIFICATIONS. Three credit hours. Civil Engineering, fourth year, third term. *M., Tu., Th., at* 10. Prerequisite, Civil Engineering 8, 10, and 34.

Lectures and recitations on the principles, practice, and law of contracts and specifications.

DRAWING

(See Engineering Drawing)

ECONOMICS AND SOCIOLOGY

(Office, Room 211, University Hall)

PROFESSOR HAGERTY, PROFESSOR HAMMOND

ECONOMICS

33. ELEMENTS OF POLITICAL ECONOMY. Three credit hours. Not open to first-year students. Industrial Arts, second year, three terms. *M., W., F., at* 8. Other Sections, *M., W., F.,* 9 *and* 11. Professor HAGERTY, Professor HAMMOND.

A careful study of the laws of production, exchange, distribution, and consumption of wealth; combined with an analysis of the industrial actions of men as regards land, labor, capital, money, credit, rent, interest, wages, etc. Text-books, lectures, and individual investigations.

*37. INDUSTRIAL ORGANIZATION. Three credit hours. Industrial Arts, fourth year, first term. *M., W., F., at* 9. Prerequisite, Economics 33. Professor HAMMOND.

*38. CORPORATION ORGANIZATION AND FINANCE. Three credit hours. Industrial Arts, fourth year, second term. *M., W., F., at* 9. Prerequisite, Economics 37. Professor HAMMOND.

*51. THE MONOPOLY PROBLEM. Three credit hours. Industrial Arts, fourth year, third term. *M., W., F., at* 9. Prerequisite, Economics 38. Professor HAMMOND.

48. ACCOUNTING AND STATISTICS. Two credit hours. Industrial Arts, third year, first, second, and third terms. *Tu., Th., at* 9.

*57. AMERICAN INDUSTRIES. Three credit hours. Industrial Arts, second and third terms. *M., W., F., at* 2. Prerequisite, 33.

---

*Not given in 1909-1910.

ELECTRICAL ENGINEERING

(Office, Engineering Laboratory, Room 171)

PROFESSOR CALDWELL, ASSOCIATE PROFESSOR HUNT, ASSISTANT PROFESSOR UPSON

5. ELECTRICAL ENGINEERING. Four credit hours. Mechanical, Mine Engineering, Industrial Arts, and Manual Training, fourth year, first and second terms; Civil and Chemical Engineering, fourth year, first term. Lectures, first term: *M., F., at* 10 *or Tu., Th., at* 10. Second term, *Tu., Th., at* 10. Laboratory: First term; Chemical Engineering, *M.,* 1 *to* 5; Civil Engineering, *F.* 1 *to* 5; Industrial Arts, Manual Training, *M.,* 1 *to* 5; Mechanical Engineering, *W.,* 1 *to* 5; *S.,* 8 *to* 12; Mine Engineering, *W.,* 1 *to* 5. Second term: Mine Engineering, Industrial Arts, Manual Training, *M.,* 1 *to* 5; Mechanical Engineering, *F.,* 1 *to* 5; *S.,* 8 *to* 12. Prerequisite, Physics 2. Associate Professor HUNT, Assistant Professor UPSON.

Lectures and laboratory work on direct and alternating circuits, dynamo machinery, transformers, accumulators and their application.

30. DIRECT CURRENT DYNAMO MACHINERY. Four credit hours. Electrical Engineering, third year, second term. *M., F., at* 9, and *W. or F.,* 1 *to* 5. Third term. *M., F., at* 10, and *W.,* 1 *to* 5, *or S.,* 8 *to* 12. Prerequisite, Physics 4. Mechanics 1. Concurrent, Physics 6. Associate Professor HUNT.

Generators and motors, their theory, construction, and operation. Lectures, recitations, problems, and laboratory.

11. ADVANCED DYNAMO LABORATORY. Three credit hours. Electrical Engineering, fourth year, first term. *Th., or F.,* 10 *to* 5. Second term. *Tu., or Th.,* 10 *to* 5. Third term. *M., or Tu.,* 10 *to* 5. Prerequisite, Electrical Engineering 15. Concurrent, 16 and 17. Professor CALDWELL, Assistant Professor UPSON.

Alternating current, railway and telephone apparatus, accumulators, illumination, etc.

15. ALTERNATING CURRENT CIRCUITS AND MACHINERY. Two credit hours. Electrical Engineering, third year, third term. *Tu., Th., at* 10. Concurrent, Electrical Engineering 30. Professor CALDWELL.

General principles, circuits, generators, and transformers.

16. Continuation of 15. Three credit hours. Electrical Engineering, fourth year, first term. *M., Tu., W., at* 11. Concurrent, Electrical Engineering 11. Professor CALDWELL.

Transformers, synchronous motors, induction motors, etc.

17. Continuation of 16. Two credit hours. Electrical Engineering, fourth year, second term. *M., W., at* 8. Concurrent, Electrical Engineering 11. Professor CALDWELL.

18. ELECTRICAL DESIGN. Three credit hours. Electrical Engineering, fourth year, second term. *M.,* 1 *to* 4, *S.,* 8 *to* 11. Prerequisite, Drawing 5. Concurrent, Industrial Arts 9. Associate Professor HUNT.

Direct and alternating current generators, transformers.

19. Continuation of 18. Four credit hours. Electrical Engineering, fourth year, third term. *Th., F.,* 1 *to* 5. Associate Professor HUNT.

20. INSPECTION TRIP TO THE EAST. Given only in the even years. Electrical Engineering, third or fourth year.

Includes Pittsburg, Buffalo, Niagara, and Cleveland; is taken at the end of the winter term and occupies six days. The entire expense need not exceed $30.00. A satisfactory written report upon the work of the trip is required.

21. INSPECTION TRIP TO THE WEST. Given only in the odd years. Electrical Engineering, fourth or third year.

Includes Chicago, Milwaukee, Fort Wayne, and possibly other places; is taken at the end of the winter term, and occupies six days. The entire expense need not exceed $30.00. A satisfactory written report on the work of the trip is required.

22. READING COURSE. Electrical Engineering, third or fourth year. This may be taken as a substitute for 20, on presentation of reasons satisfactory to the head of the department.

Course of assigned reading upon processes of manufacture and power plants.

23. Similar to 22. A substitute for 21.

24. APPLICATIONS OF ELECTRICITY. Two credit hours. Electrical Engineering, fourth year, second term. *Tu., Th., at* 8. Prerequisite, Electrical Engineering 8. Professor CALDWELL, Assistant Professor UPSON.

Brief treatment of the elements of illumination, railway work, telephone, mining, etc.

25. ELECTRICAL TRANSMISSION AND DISTRIBUTION. Two credit hours. Electrical Engineering, fourth year, third term. *Tu., Th., at* 8. Prerequisite, Electrical Engineering 8. Professor CALDWELL.

Systems, apparatus, and operation.

26. ELECTRICAL RAILWAYS. Three credit hours. Electrical Engineering, fourth year, third term. *M., W., F., at* 8. Alternative

with courses 27, 28, and 29. Prerequisites, Electrical Engineering 17 and 24. Professor CALDWELL.

Principles, general design, and operation of transmission and distribution systems, cars, and motors.

27. TELEPHONY. Three credit hours. Electrical Engineering, fourth year, third term. *M., W., F., at* 9. Alternative with courses 26, 28, and 29. Prerequisite, Electrical Engineering 17 and 24. Assistant Professor UPSON.

Methods of operation. Simple circuits and apparatus. Elements of transmission theory.

28. ELECTRIC ILLUMINATION. Three credit hours. Electrical Engineering, fourth year, third term. *Tu., Th., at* 9, *F., at* 10. Alternative with 26, 27, and 29. Prerequisite, Electrical Engineering 17 and 24. Professor CALDWELL.

Principles of illumination, electric lamps, wiring plans, etc.

29. WIRELESS TELEGRAPHY. Three credit hours. Electrical Engineering, fourth year, third term. *M., W., F., at* 8. Alternative with courses 26, 27, and 28. Prerequisite, Electrical Engineering 17 and 24. Assistant Professor UPSON.

Elementary theory, production, transmission, and detection of damped and undamped oscillations.

30. (See above.)

31. ELECTRICAL ENGINEERING. Five credit hours. Civil Engineering, third year, first term. *M., W., F., at* 11 *and Tu., or Th.,* 1 *to* 5. Prerequisite, Physics 2. Associate Professor HUNT, Assistant Professor UPSON.

Electrical circuits, dynamo machinery, transformers, accumulators, and their applications.

32. SPECIAL READING AND LABORATORY WORK. Credit hours to be arranged. Open only to fourth year and graduate students with the consent of the instructor in charge. Prerequisite, Electrical Engineering 30 and 15.

ENGINEERING DRAWING

(Office, Brown Hall, Room 42)

PROFESSOR FRENCH, ASSISTANT PROFESSOR LEWIS, ASSISTANT PROFESSOR ROGERS, ASSISTANT PROFESSOR MEIKLEJOHN, MR. TIDBALL, MR. BOTT, MR. NORRIS

1. ELEMENTARY MECHANICAL DRAWING. Two credit hours. Practice in the use of drawing instruments, elementary projections.

All four year courses, first year, first term. *M., F.,* 9 *to* 11; *Tu., Th.,* 9 *to* 11; *M., Tu.,* 1 *to* 3; *Th., F.,* 1 *to* 3; *W.,* 1 *to* 3, *S.,* 8 *to* 10.

2. LETTERING. Two credit hours. All four-year courses, first year, second term. (Same hours as 1.) Prerequisite, Drawing 1.

2a. LETTERING. Three credit hours. Short courses (no prerequisite.) Elementary drawing and lettering. Short Clayworking and Industrial Arts, first year. Short Mining, second year, first term. *M., Tu.,* 1 *to* 4; *Th., F.,* 1 *to* 4.

3. PROJECTION DRAWING. Three credit hours. All four-year courses, third term. Lectures, *M., at* 8; *W., at* 8 *or* 9; *Th., at* 8; *F., at* 8 *or* 9. Practice, time same as course 1. Prerequisite, Drawing 2.

5. TECHNICAL DRAWING. Three credit hours. Electrical and Mechanical Engineering, Industrial Arts, and Manual Training, third year, first term. *M., Tu.,* 1 *to* 4, *or Th., F.,* 1 *to* 4. Prerequisite, Drawing 35. Professor FRENCH, Assistant Professor ROGERS.

Rules and methods for making working drawings in machine design to represent correctly form and dimensions for shop use, and for tracing and blue-printing the same.

14. PEN DRAWING. Two credit hours. Architecture, second year, second and third terms. *M., Tu.,* 1 *to* 3. Prerequisite, Drawing 26. Mr. NORRIS.

18. WATER COLOR PAINTING. Two credit hours. Architecture, third year, second term. *Tu., Th.,* 9 *to* 11. Prerequisite, Drawing 26. Mr. NORRIS.

19. WATER COLOR PAINTING. Two credit hours. Architecture. third year, third term. *Tu., Th.,* 8 *to* 10. Prerequisite, Drawing 18. Mr. NORRIS.

21. TECHNICAL DRAWING. Two credit hours. Chemical Engineering, third year, first term. *W.,* 1 *to* 5. Assistant Professor ROGERS.

22. TECHNICAL DRAWING. Two credit hours. Chemical Engineering, third year. Ceramics, fourth year, second term. *S.,* 8 *to* 12. Prerequisite, Drawing 21 or 39. Professor FRENCH.

23. TECHNICAL DRAWING. Two credit hours. Chemical Engineering, third year. Ceramics, fourth year, third term. *S.,* 8 *to* 12. Prerequisite, Drawing 22. Professor FRENCH.

24. FREE HAND DRAWING. One credit hour. Short Industrial Arts, first year, first term. *S.,* 10 *to* 12. Mr. TIDBALL.

Pencil drawing from models and plaster casts.

25. FREE HAND DRAWING. One credit hour. Short Industrial Arts, first year, second term. *S.*, 10 *to* 12. Prerequisite, Drawing 24. Mr. TIDBALL.

Pencil drawing from models and plaster casts.

26. FREE HAND DRAWING. One credit hour. Short Industrial Arts, first year, third term. *S.*, 10 *to* 12. Prerequisite, Drawing 25. Mr. TIDBALL.

Brush work from plaster casts and still life.

33. PROJECTION DRAWING. Three credit hours. Second year, first term. (For 1909 only.)

LECTURES	PRACTICE	COURSE IN
M., at 10	*Tu., Th.,* 9 *to* 11	Architecture
W., at 11	*M., F.,* 10 *to* 12	Ceramic Engineering
W., at 11	*Tu., Th.,* 9 *to* 11	Chemical Engineering
M., at 10	*Tu., Th.,* 9 *to* 11	Civil Engineering
Tu., at 8 *or* 11	*M., F.,* 10 *to* 12	Electrical Engineering
W., at 11	*M., F.,* 10 *to* 12	Industrial Arts
Tu. or W., at 11	*M., F.,* 10 *to* 12	Mechanical Engineering
W., at 11	*Tu., Th.,* 9 *to* 11	Mine Engineering

Prerequisite, Drawing 2 or 32. Professor FRENCH, Assistant Professor ROGERS, Assistant Professor MEIKLEJOHN, Mr. BOTT.

Lectures and practice. Orthographic, isometric, and oblique projections, and elementary working drawings.

34. DESCRIPTIVE GEOMETRY. Three credit hours. Lectures and practice. Second year, second term. For 1909-10 only; thereafter to be given in first term.

LECTURES	PRACTICE	COURSE IN
M., W., at 11	*F.,* 10 *to* 12	Ceramic Engineering
M., W., at 11	*Th.,* 9 *to* 11	Chemical Engineering
Tu., Th., at 8 *Tu., Th., at* 11	*F.,* 10 *to* 12	Electrical Engineering
M., W., at 11	*F.,* 10 *to* 12	Industrial Arts
Tu., Th., at 8 *Tu., Th., at* 11	*F.,* 10 *to* 12	Mechanical Engineering
Tu., Th., at 11	*Tu.,* 9 *to* 11	Mine Engineering
Tu., Th., at 8	*Tu.,* 9 *to* 11	Short Industrial Arts

Prerequisite, Drawing 33 or 38. Professor FRENCH, Assistant Professor ROGERS, Assistant Professor MEIKLEJOHN, Mr. BOTT.

35. Advanced Descriptive Geometry. Three credit hours. Second year, third term. (1909-10 only; thereafter to be given in second term.)

LECTURES	PRACTICE	COURSE IN
M., at 10	*Tu., Th.,* 9 *to* 11	Civil Engineering
Tu., at 11 *W., at* 11	*M., F.,* 10 *to* 12	Electrical Engineering
W., at 11	*M., F.,* 10 *to* 12	Industrial Arts
W., at 11	*M., F.,* 10 *to* 12	Mechanical Engineering
Tu., at 11	*Tu., Th.,* 9 *to* 11	Mine Engineering
M., at 10	*Tu., Th.,* 9 *to* 11	Short Industrial Arts

Prerequisite, Drawing 34 or 36. Professor French, Assistant Professor Rogers, Assistant Professor Meiklejohn, Mr. Bott.

36. Descriptive Geometry. Five credit hours. Architecture and Civil Engineering, second year, second term. *M., W., F., at* 8, *Tu., Th.,* 9 *to* 11, *or M., W., F., at* 11, *Tu., Th.,* 9 *to* 11. Prerequisite, Drawing 33 or 38. Professor French, Assistant Professor Rogers, Assistant Professor Meiklejohn, Mr. Bott.

38. Projection Drawing. Three credit hours. Short Clay-working and Industrial Arts, first year. Short Mining, second year, second term. *M., Tu.,* 1 *to* 4 *or Th., F.,* 1 *to* 4. Prerequisite, Drawing 2. Assistant Professor Meiklejohn.

Orthographic. isometric, and oblique projections and intersections.

39. Drafting and Blue-Printing. Three credit hours. Short Clay-working and Industrial Arts, first year. Short Mining and Ceramics, second year, third term. *M., Tu.,* 1 *to* 4 *or Th., F.,* 1 *to* 4. Prerequisite, Drawing 33 or 38. Assistant Professor Rogers, Assistant Professor Meiklejohn.

40. Clay Modeling. Two credit hours. Architecture, third year, second term. *Th., F.,* 1 *to* 3. Prerequisite, Drawing 26. Assistant Professor Lewis.

Modeling in clay, ornamental forms from plaster casts, photographs, and nature.

41. Clay Modeling. Two credit hours. Architecture, third year, third term. *Th., F.,* 1 *to* 3. Prerequisite, Drawing 40. Assistant Professor Lewis.

Modeling in clay and wax from photographs, nature, and original designs. Casts made in plaster and gelatine molds.

42. Charcoal Drawing from Architectural Ornament. Two credit hours. Architecture, second year, first term. *M., F.,* 1 *to* 3. Prerequisite, Drawing 26. Mr. Tidball.

43. CHARCOAL DRAWING FROM THE ANTIQUE. Two credit hours. Architecture, fourth year, first term. *M., F.*, 10 *to* 12. Prerequisite, Drawing 19. Mr. TIDBALL.

ENGLISH

(Office, University Hall, Room 116)

PROFESSORS DENNEY, TAYLOR, MC KNIGHT, ASSOCIATE PROFESSOR GRAVES, ASSISTANT PROFESSORS DUNCAN, BLANCHARD, LEIGHTON, COOPER, BURNHAM, MR. BECK

1. PARAGRAPH WRITING AND ANALYSIS OF PROSE. Two credit hours. First term. *Tu., Th., or W., F., at* 8, *Tu., Th., at* 9, 10, 11, 1 *or* 2, *M., F., at* 10, 11, *or* 2, *W., F., at* 3. (Course 1 will be repeated in the second term and the third term for the benefit of those who fail, the class meeting Saturdays at 9 a. m., Room 119.) All instructors.

2. EXPOSITORY WRITING. Two credit hours. Second term. Prerequisite, course 1. Same hours as for course 1. (Course 2 is also offered in the Summer Term.) All instructors.

3. BRIEF MAKING AND WRITTEN ARGUMENTATION. Two credit hours. Third term. Prerequisite, course 1. Same hours as for course 1. (Course 3 is also offered in the Summer Term.) All instructors.

FRENCH

(See Romance Languages and Literatures)

GEOLOGY

(Office, Orton Hall, Room 1)

PROFESSOR PROSSER, PROFESSOR BOWNOCKER, ASSISTANT PROFESSOR HUBBARD, MR. MORSE

1. PHYSIOGRAPHY. Five credit hours. Short Mining, first year. Short Industrial Arts, second year, third term. *M., Tu., W., Th., at* 11; laboratory, *Tu.*, 1 *to* 3. Assistant Professor HUBBARD.

The topographic features of the earth's surface and the agencies producing these. The atmosphere, climate, etc. Oceans, rivers, and lakes. Recitations, lectures, map work, and field work.

2. GENERAL GEOLOGY. Five credit hours. Ceramic and Mine Engineering, fourth year, first term. Lectures and recitations, *M., Tu,. W., F., at* 11; laboratory, *Th.*; field work first half of term, *F.* afternoon or *S.* forenoon, when the *F.* lecture will be omitted. Professor PROSSER, Mr. MORSE.

Structural, dynamical, and historical geology. The lectures are illustrated by maps, specimens, and lantern views. The common rock-forming minerals and rocks are studied in the laboratory; while in the field specimens are collected, sections measured, formations identified, and the student given an idea of the method of work pursued by a field geologist.

4. ELEMENTARY GEOLOGY. Five credit hours. Short Mining, second year, second term. *M., Tu., W., Th., F., at* 9. Assistant Professor HUBBARD.

Lithological, dynamical, structural, and historical geology. Recitations, lectures, laboratory work.

6. ECONOMIC GEOLOGY. Three credit hours. Ceramic and Mine Engineering, fourth year, second term. *M., W., F., at* 11. Prerequisite, Geology 2. Professor BOWNOCKER.

The nature of ores, their classification, and origin. The metallic ores of the United States, their distribution, abundance, modes of occurrence, and origin. The non-metals, coal, oil, gas, clay, lime, cement, building stone, etc. In the discussion of the non-metals emphasis will be laid on the products of Ohio.

7. PETROGRAPHY. Two credit hours. Ceramic and Mine Engineering, fourth year, second term. *Tu.,* 1 *to* 3, *Th., at* 11. Concurrent, Geology 6. Professor BOWNOCKER.

The igneous, sedimentary, and metamorphic rocks, their origin, classification, and alternation products.

24. GENERAL GEOLOGY. Five credit hours. Civil Engineering, fourth year, third term. Lectures and recitations, *M., Tu., W., at* 11; laboratory, *Th.*; field work, *F., or S.* Professor PROSSER, Mr. MORSE.

GERMANIC LANGUAGES AND LITERATURES

(Office, University Hall, Room 317)

PROFESSOR RHOADES, ASSOCIATE PROFESSOR EISENLOHR, ASSISTANT PROFESSORS THOMAS AND BUSSE, MR. BUSEY, MISS BARROWS

1. ELEMENTARY GERMAN. Four credit hours. First, second, and third terms. *M., Tu., Th., F., at* 9, 10, 11, *or* 2, *Tu., W., Th., F., at* 3.

German 1 may be taken by students who enter with no entrance credits in German.

2. SCIENCE READING. Four credit hours. Third term. *M., Tu., Th., F., at* 9, 10, *or* 2. Prerequisite, German 4.

German 2 must be taken by all Engineering students who take German 4 in the first and second terms.

4. INTERMEDIATE GERMAN. Four credit hours. First and second terms. *M., Tu., Th., F., at* 9, 10, *or* 2. Prerequisite, German 1, or two units entrance German.

Review of Grammar. Reading of descriptive and narrative prose, with prose composition. German 4 should be taken by Engineering students who enter with two units entrance German.

INDUSTRIAL ARTS

(Office, Hayes Hall, Room 2)

PROFESSOR SANBORN, ASSISTANT PROFESSOR KNIGHT, MR. CROWE, MR. CASE, MR. BEEM, AND MR. DENMAN

INDUSTRIAL ARTS

1. TOOLS AND MACHINES. Three credit hours. Industrial Arts and Manual Training, third year. Short Industrial Arts, second year, first, second, and third terms. *M., W., F., at* 9. Prerequisite, Mathematics 14 or 32. Concurrent, Physics 1. Professor SANBORN.

Principles underlying the construction and operation of machine tools, and materials used in construction.

2. DESIGNING. Three credit hours. Industrial Arts and Manual Training, third year. Short Industrial Arts, second year, second and third terms. *F.,* 1 *to* 4; *S.,* 8 *to* 11. Professor SANBORN.

Problems in design, to accompany 1.

3. SHOP EQUIPMENT, APPLIANCES, AND MANAGEMENT. Three credit hours. Industrial Arts, fourth year, first, second, and third terms. *M., W., F., at* 11. Prerequisite, Industrial Arts 1. Concurrent, Industrial Arts 4. Professor SANBORN.

Strength and durability of the materials used in construction; shop and factory buildings and their construction; power, power transmission and prime movers; methods of compensation, and shop accounts and management.

4. ADVANCED DESIGNING. Three credit hours. Industrial Arts, fourth year, first, and second terms. *M., Tu.,* 1 *to* 4. Third term. *W., Th.,* 1 *to* 4. Prerequisite, Drawing 5. Concurrent, Industrial Arts 3. Professor SANBORN.

Graphical problems in construction. Design of buildings and the arrangement of machinery, line-shafting, etc., for manufacturing plants.

5. WORKSHOP APPLIANCES. Three credit hours. Mechanical Engineering, fourth year, third term. *M., W., F., at* 8. Prerequisite, Civil Engineering 19. Professor SANBORN.

Lectures and problems on the construction of shop buildings and the arrangement of machinery; special shop appliances.

8. MACHINE DRAWING. Three credit hours. Short Industrial Arts, second year, first term. *Th., F.,* 1 *to* 4. Prerequisite, Drawing 39. Professor SANBORN.

Working sketches of mechanisms and machines from measurement; detail and assembly drawings of same.

9. MACHINE DESIGN. Two credit hours. Electrical Engineering, fourth year, second term. *M., F.,* 10 *to* 12. Prerequisite, Mechanics 2, and Drawing 5. Professor SANBORN.

Practical application of the principles of machine design.

SHOPWORK

NOTE.—For time requirements, credit given, and all similar information concerning shopwork courses, see Time Schedule Bulletin.

3. FOUNDRY WORK. Mr. BEEM.

Exercises and practice in tempering sand and preparing molds of machine parts in the sand, core-making, melting iron and brass, and pouring castings.

4. CHIPPING AND FILING. Assistant Professor KNIGHT, Mr. CASE.

Exercises and practice in vise work, including chipping in cast and wrought iron, surface filing, squaring, fitting, finishing, and the scraping of surface plates.

7. CARPENTRY AND PATTERN MAKING. Mr. BEEM, Mr. DENMAN.

Exercises and practice in carpentry, wood-turning, and pattern-making, including sawing, planing, mortising, framing, and other work, involving the use of the ordinary carpenter tools; center and chuck turning, the making of finished patterns; and enough elementary molding to illustrate draft, parting, cores, etc.

8. CABINET WORK. Prerequisite, Shop 7. Mr. BEEM, Mr. DENMAN.

Exercises and practice in cabinet making, including paneling, mitre and dovetail joints, etc.; use of power tools.

9. ADVANCED PATTERN MAKING. Continuation of pattern work of Shopwork 7. Mr. BEEM, Mr. DENMAN.

11. FORGING. Mr. CROWE.

The use and care of forge, fire, and tools; practice in iron and steel forging, including such operations as cutting, bending, drawing, upsetting, shaping and welding iron; the making, hardening and tempering of steel punches, chisel and lathe tools.

12. ADVANCED FORGING. Prerequisite, Shop 11. Mr. CROWE.

Various forms of welds in iron and steel; the use of scrolling irons and of forms for duplicating work; annealing; tool-making; case-hardening; tempering drills, dies, and cutters; spring-making; ornamental iron work; visits to shops.

13. MACHINE WORK. Assistant Professor KNIGHT, Mr. CASE.

Exercises and practice in straight and taper turning, boring, fitting, chucking, and thread-cutting on engine lathes.

14. MACHINE WORK. Prerequisite, Shop 13. Assistant Professor KNIGHT, Mr. CASE.

Exercises and practice on the lathe, planer, shaper, drill press, and milling machine, with use, of small tools as drills, taps, dies, reamers, counter-borers, etc.; construction of parts of actual machines.

15. ADVANCED MACHINE WORK. Prerequisite, Shop 14. Assistant Professor KNIGHT.

Exercises and practice on turret lathe, universal, surface, and tool grinding machines; in gear-cutting, etc.

16. ADVANCED MACHINE WORK. Prerequisite, Shop 15. Assistant Professor KNIGHT.

The construction and use of jigs and templates; the accurate laying out of work; the duplication of parts; the production of work rapidly and economically, etc.

17. ADVANCED MACHINE WORK. Prerequisite, Shop 16. Assistant Professor KNIGHT.

The making and use of special tools and fixtures, standard plugs and collars, standard caliper and limit gauges; error limits in modern machine construction; methods of testing the accuracy of machine tools, etc.

SUMMER TERM. The Summer Term in Shopwork will begin on Monday morning preceding Commencement Day and continue for four weeks. The courses open to students are Shopwork 4, 7, 11, 13, 14, and 15, three credit hours in each. Each course requires three hours a day for six days a week.

Students electing the Ceramics or the Electrical or Mechanical Engineering Course are required to take two of the three courses, Shopwork 4, 7, and 11 at the close of their first year.

Students electing the Chemical Engineering Course are required to take Shopwork courses 7 and 11 at the close of their first or second year.

Students electing the Industrial Arts Course or the Short Course in Clay-working are required to take Shopwork 7 and 11 at the close of their first year.

The courses are open as elective to students who desire to lighten their work of the regular terms, to make up back work or to take extra work.

MATHEMATICS

(Office, University Hall, Room 314)

PROFESSOR BOHANNAN, PROFESSOR MCCOARD, PROFESSOR SWARTZEL, PROFESSOR KUHN, ASSOCIATE PROFESSOR ARNOLD, ASSOCIATE PROFESSOR RASOR, ASSISTANT PROFESSOR PRESTON, ASSISTANT PROFESSOR BAREIS, ASSISTANT PROFESSOR MORRIS, MR. WEST

2. ELEMENTARY ALGEBRA. Five credit hours. Text-book: Wentworth's Algebra. Short Clay-working, Industrial Arts, and Mining, first year, first, second, and third terms. *M., Tu., W., Th., F., at* 9.

3. PLANE GEOMETRY. Five credit hours. Text-book: Venable's Geometry. Short Clay-working, Industrial Arts, and Mining, first year, first term. *M., Tu., W., Th., F., at* 8.

11. DIFFERENTIAL EQUATIONS. One credit hour. Text-book: Boyd's Differential Equations. Mechanical Engineering, third year, first term. *F., at* 10. Prerequisite, Mathematics 43.

13. SOLID GEOMETRY. Five credit hours. Text-book: Venable's Geometry. Short Clay-working, Industrial Arts, and Mining, first year, second term. *M., Tu., W., Th., F., at* 8. Prerequisite, Mathematics 3.

14. PLANE TRIGONOMETRY. Five credit hours. Text-book: Bohannan's Trigonometry. Short Clay-working, Industrial Arts, and Mining, first year, third term. *M., Tu., W., Th., F., at* 8.

31. COLLEGE ALGEBRA. Five credit hours. Text-book: Metzler, Rowe and Bullard's College Algebra. All four-year courses, first year, first term, *M., Tu., W., Th., F., at* 8, 9, 11, 2, *or* 3.

This course is repeated in the second term for the benefit of students who fail in it in the first term.

32. TRIGONOMETRY. Five credit hours. Text-book: Bohannan's Trigonometry. All four-year courses, first year, second term. *M., Tu., W., Th., F., at* 8, 9, 11, 2, *or* 3.

This course is repeated in the third term for the benefit of students who fail in it in the second term.

33. ANALYTICAL GEOMETRY. Five credit hours. Text-book: Nichol's Analytical Geometry. All four-year courses, first year, third term. *M., Tu., W., Th., F., at* 8, 9, 11, 2, *or* 3. Prerequisite, Mathematics 32.

This course is repeated in the Summer Term.

41. CALCULUS. Five credit hours. Text-book: Osborne's Calculus. All four-year courses, second year, first term. *M., Tu., W., Th., F., at* 8, 9, *or* 11. Prerequisite, Mathematics 33.

42. CALCULUS. Five credit hours. Text-book: Edwards' Differential Calculus for Beginners. Second year, second term. For hours and courses see Course 41. Prerequisite, Mathematics 41.

43. CALCULUS. Five credit hours. Text-book: Murray's Integral Calculus. Second year, third term. For hours and courses see Course 41. Prerequisite, Mathematics 41.

74. DIFFERENTIAL EQUATIONS. Three credit hours. Second term. Elective. Prerequisite, Mathematics 43. Text-book: Boyd's Differential Equations.

HIGHER MATHEMATICS. Elective. See Bulletin of the College of Arts, Philosophy, and Science for special courses.

MECHANICAL ENGINEERING.

(Office, Engineering Laboratory, Room 244)

PROFESSOR MAGRUDER, PROFESSOR HITCHCOCK, ASSISTANT PROFESSOR JUDD, ASSISTANT PROFESSOR RIGDON, MR. FISHER, MR. CALDERWOOD

3. MECHANISM. Five credit hours. Mechanical Engineering, third year, second term. *M., Tu., W., Th., F., at* 8. Prerequisite, Drawing 33 and Physics 2. Two credit hours. Mechanical Engineering, third year, third term. *M.,* 1 *to* 5. Professor HITCHCOCK.

Lectures, recitations, and practice on the principles of mechanism and mechanical movements.

12. EXPERIMENTAL ENGINEERING LABORATORY. Two credit hours. Mechanical Engineering, third year, first term. *W.,* 1 *to* 5, *or S.,* 8 *to* 12. Industrial Arts, fourth year, first term. *Th.,* 1 *to* 5. Prerequisite, Drawing 33 and Physics 2. Concurrent, Mechanics 1, or Industrial Arts 3. Assistant Professor RIGDON, Mr. CALDERWOOD.

Calibration of pressure gauges and indicator springs; steam engine indicator practice and oil testing. Not given after 1909-'10.

27. Continuation of 12. Five credit hours. Mechanical Engineering, fourth year, first term. *M., Tu.,* 1 *to* 5; *Tu.,* 10 *to* 12.

Concurrent, Mechanical Engineering 33. Professor HITCHCOCK, Assistant Professors JUDD and RIGDON.

Testing materials of construction, tests of steam and hot-air engines, transmission and absorption dynamometer trials, and testing of belts.

14. Continuation of 27. Five credit hours. Mechanical Engineering, fourth year, second term. *M.*, 10 *to* 12; *M., and T.*, 1 *to* 5. Concurrent, Mechanical Engineering 34. Professor HITCHCOCK, Assistant Professors JUDD and RIGDON.

Testing of steam boilers and injectors.

15. Continuation of 14. Four credit hours. Mechanical Engineering, fourth year, third term. *M., Tu., F.*, 9 *to* 12. Professor HITCHCOCK, Assistant Professors JUDD and RIGDON.

Testing of steam, centrifugal, and power pumps, pulsometer, hydraulic rams, impulse and turbine water-wheels, and air compressors.

18. MACHINE DESIGN. Five credit hours. Chemical and Mechanical Engineering, fourth year, first, and second terms. *M., Tu., W., Th., F., at* 9. Prerequisite, Drawing 5 or 33; Mechanics 3; Metallurgy 4. Professor MAGRUDER.

19. MACHINE DESIGN. Five credit hours. Chemical and Mechanical Engineering, fourth year, third term. *M.*, 1 *to* 5, *Tu., W.*, 1 *to* 4. Prerequisite, Mechanical Engineering 18. Professor MAGRUDER.

Practical applications of the principles of machine design.

21. THESIS WORK. Five credit hours. Mechanical Engineering, fourth year, third term. Professors MAGRUDER and HITCHCOCK.

23. MATERIALS OF CONSTRUCTION. Four credit hours. Architecture, fourth year, first term. *Tu.*, 8 *to* 10; *Th.*, 8 *to* 11; *F., at* 8. Prerequisite, Mechanics 1. Professor HITCHCOCK.

Lectures and recitations on the materials used in architectural and building construction, and laboratory exercises on their properties.

24. EXPERIMENTAL ENGINEERING LABORATORY. Three credit hours. First and second terms. Elective to third and fourth year engineers. (Not given in 1909-1910.)

Arranged to meet the needs of those desiring to elect advanced laboratory work.

28. EXPERIMENTAL ENGINEERING LABORATORY. Two credit hours. Electrical Engineering, third year, third term. *W., or F.*, 1 *to* 5. Manual Training, fourth year, third term. *F.*, 1 *to* 5. Con-

current, Mechanical Engineering 32. Assistant Professors JUDD and RIGDON.

Testing of pressure gauges and indicator springs, steam engine indicator practice, and testing of lubricating oils.

29. Continuation of 28. Three credit hours. Electrical Engineering, fourth year, first term. *Th., or F.,* 10 *to* 12, 1 *to* 5. Two credit hours. Industrial Arts, fourth year, second term. *W.,* 1 *to* 5. Assistant Professors JUDD and RIGDON.

Testing materials of construction, transmission and absorption dynamometer tests, steam engine trials.

30. Continuation of 29. Two credit hours. Electrical Engineering, fourth year, second term. *W., or Th.,* 1 *to* 5. Industrial Arts, fourth year, third term. *F.,* 1 *to* 5. Assistant Professors JUDD and RIGDON.

Steam engine and boiler trials, steam and power pump tests, hydraulic experimentation, gas and oil engine trials.

31. HYDRAULIC MACHINERY. Two credit hours. Mechanical Engineering, fourth year, third term. *Tu., Th., at* 8. Prerequisite, Mechanics 3, and Mechanical Engineering 33. Professor HITCHCOCK.

Recitations and lectures on pumping machinery.

32. MECHANICAL ENGINEERING OF POWER PLANTS. Five credit hours. Chemical and Mechanical Engineering and Industrial Arts, third year, third term. *M., Tu., W., Th., F., at* 8. Electrical Engineering, third year, third term. *M., Tu., W., Th., F., at* 9. Manual Training, fourth year, third term. *M., Tu., W., Th., F., at* 8. Prerequisite, Mechanical Engineering 3, or Industrial Arts 1; Drawing 5 or 22, and Physics 2. Professor MAGRUDER.

A descriptive study of steam and gas engines, boilers, pumps, injectors, and other machinery used in plants generating power.

33. STEAM ENGINES AND BOILERS. Five credit hours. Electrical and Mechanical Engineering, fourth year, first term. *M., Tu., W., Th., F., at* 8. Prerequisite, Mechanics 3, and Mechanical Engineering 32. Professor MAGRUDER.

A detail study of steam-generating and steam-using machinery.

34. THERMODYNAMICS. Five credit hours. Mechanical Engineering, fourth year, second term. *M., Tu., W., Th., F., at* 8. Prerequisite, Mechanical Engineering 33. Professor MAGRUDER.

The transmutations of heat and mechanical energies in steam, gas, and air engines, in air and ammonia compressors and in refrigeration machines, together with a study of the tests of ideal and actual engines and of their indicator diagrams; the flow of gases through pipes and orifices.

35. EXPERIMENTAL ENGINEERING LABORATORY. Three credit hours. Option, Chemical Engineering, fourth year, second term. *F., at* 11; *F.,* 1 *to* 5. Prerequisite, Mechanics 3, and Mechanical Engineering 32. Assistant professors JUDD and RIGDON,

Testing of pressure gauges and indicator springs followed by steam engine indicator practice with engine and pump economy tests; testing of lubricating oils; ventilating fan trials and boiler fuel tests; accompanied by lectures relating to apparatus used in the experimentations.

36. EXPERIMENTAL ENGINEERING LABORATORY. Five credit hours. Ceramic and Mine Engineering, fourth year, third term. *Tu., Th., at* 9, *Tu.,* 10 *to* 12, 1 *to* 5, *or Th.,* 10 *to* 12, 1 *to* 5. Prerequisite, Mechanics 3, and Metallurgy 4. Professor HITCHCOCK, Assistant Professors JUDD and RIGDON.

Lectures and recitations on power transmission, steam engines and boilers. Laboratory; testing pressure gauges, indicator springs, etc.; valve setting; testing of steam engines, steam, power, and centrifugal pumps; boiler and fuel trials.

37. MECHANISM. Four credit hours. Electrical Engineering, third year, second term. *M., Tu., Th., F., at* 8 *or* 10. Assistant Professors JUDD and RIGDON.

Lectures and recitations on the principles of mechanism and mechanical movements.

38. INSPECTION TRIP TO THE EAST. Given only in the even years. Mechanical Engineering, third or fourth year.

Includes Pittsburg, Buffalo, Niagara Falls, Cleveland, and possibly other places; is taken at the end of the winter term, and occupies six days. The entire expense need not exceed $30.00. A satisfactory written report upon the work of the trip is required.

39. INSPECTION TRIP TO THE WEST. Given only in the odd years. Mechanical Engineering, fourth or third year.

Includes Chicago, Milwaukee, and possibly other places; is taken at the end of the winter term and occupies six days. The entire expense need not exceed $30.00. A satisfactory written report upon the work of the trip is required.

40. WRITTEN REPORT. Course of assigned reading upon processes of manufacture and power plants may be reported upon by third and fourth-year students in Mechanical Engineering as a substitute for 38 on presentation of reasons satisfactory to the head of the department.

41. Similar to 40. A substitute for 39.

42. HEATING AND VENTILATING. Three credit hours. Architecture, fourth year, second term. *M., W., F., at* 9. Professor HITCHCOCK.

Recitations and lectures on the principles and methods of heating and ventilation, with laboratory work and investigations of the heating and ventilating plants of different buildings.

43. MECHANISM AND DESIGN. Five credit hours. Ceramic Engineering, third year, third term. *M., Tu., W., Th., F., at* 8. Assistant Professor JUDD.

Lectures and recitations on the principles of mechanism, mechanical movements, and elementary machine design.

*44. MECHANISM AND MACHINE DESIGN. Four credit hours. Civil Engineering, fourth year, second term. *M., T., Th., at* 11. Prerequisite, Mechanics 3. Professor MAGRUDER.

Lectures and recitations on the principles of mechanism and elementary machine design, adapted for civil engineering students. (First given in 1910-'11.)

45. STEAM TURBINES. Three credit hours. Mechanical Engineering, fourth year, third term. *M., W., F., at* 8. Prerequisite, Mechanical Engineering 34. Professor HITCHCOCK.

46. EXPERIMENTAL ENGINEERING. Five credit hours. Civil Engineering, fourth year, first term. *W., at* 11, *W.,* 1 *to* 5, *S.,* 8 *to* 12. Prerequisite, Drawing 33, and Mechanics 3. Professor HITCHCOCK, Assistant Professors JUDD and RIGDON.

Practice in the testing of materials of construction, calibration of orifices and weirs, study of the flow of liquids and gases, accompanied by lectures and recitations on steam engines, boilers, and power transmission.

47. Continuation of 46. Three credit hours. Civil Engineering, fourth year, second term. *Th., at* 11; *F.,* 1 *to* 5. Professor HITCHCOCK, Assistant Professors JUDD and RIGDON.

Tests of steam, power, rotary, and centrifugal pumps; water motor and turbine wheel.

MECHANICS

(Office, Mines Building, Room 219)

PROFESSOR J. E. BOYD, ASSOCIATE PROFESSOR CODDINGTON, MR. BUCHER

1. STATICS. Five credit hours. Architecture, Ceramic, Chemical, Civil, Electrical, Mechanical, and Mine Engineering, third year, first term. *M., Tu., W., Th., F.,* 8, 9, *or* 11. Prerequisite, Mathematics 43. Text-book: Hoskins' Theoretical Mechanics.

2. Strength of Materials, Kinetics. Five credit hours. Architecture, Ceramic, Chemical, Civil, Electrical, Mechanical, and Mine Engineering, third year, second term. *M., Tu., W., Th., F.,* 8, 9, 11, *or* 2. Prerequisite, Mechanics 1. Text-book: Merriman's Mechanics of Materials, Cambria Steel.

3. Kinetics and Hydraulics. Five credit hours. Chemical, Civil, Electrical, Mechanical, and Mine Engineering, third year, third term. *M., Tu., W., Th., F.,* 8, 9, *or* 11. Prerequisite, Mechanics 2. Text-books: Hoskins' Theoretical Mechanics, Goodman's Mechanics of Engineering.

METALLURGY AND MINERALOGY.

(Office, School of Mines Building)

PROFESSOR N. W. LORD, ASSOCIATE PROFESSOR SOMERMEIER,* ACTING ASSISTANT PROFESSOR DEMOREST, MR. MC QUIGG

2. Mineralogy and Crystallgraphy. Three credit hours. Mine Engineering, second year, third term. *M., W., F., at* 11. Prerequisite, Chemistry 12. Lectures arranged so as to be preparatory to Determinative Mineralogy. Professor Lord.

3. Determinative Mineralogy. Five credit hours. Mine Engineering, third year, third term. *M., Tu.,* 1 *to* 5. Prerequisite, Metallurgy 2. Professor Lord, Assistant Professor Demorest.

Lecture and laboratory work in practical determination of minerals by physical and chemical tests. Each student is furnished with a set of apparatus and works under an instructor's inspection. Brush and Penfield's Determinative Mineralogy is used as a manual.

4. Metallurgy. Five credit hours. Mine Engineering, third year, first, and second terms. Industrial Arts and Mechanical Engineering, third year, first term, and first two-fifths of second term. Ceramics, fourth year, first term. *M., Tu., W., Th., F., at* 9. Prerequisite, Chemistry 12, and Physics 2. Professor Lord.

A course of lectures upon fuel and its uses, iron and steel, copper, lead, gold, and silver, their properties, tests, ores, and details of the methods of reduction. The lectures are supplemented by a careful study of references to standard works and journals.

5. Metallurgical Laboratory. Five credit hours. Mine Engineering, second year, second, and third terms. *M., Tu., W., or W., Th., F.,* 1 *to* 4. Mine Engineering, third year, first term.

---

*Absent on leave, 1908-1909.

Three credit hours. *Th., F., 1 to 4.* Prerequisite, Chemistry 12, and one term each Chemistry 20, and Chemistry 40. Assistant Professor DEMOREST.

Lectures and laboratory work. Laboratory practice in the analysis of iron and steel, fuel and slags, and the assay of lead, copper, and zinc ores by wet methods, using approved methods as practiced in technical laboratories and metallurgical works.

6. ASSAYING. Five credit hours. Mine Engineer, third year, second term. *M., Tu., at* 11; laboratory, *M., Tu.,* 1 *to* 5, *or Th., F.,* 1 *to* 5. Prerequisite, one term of Metallurgy 5. Professor LORD, Assistant Professor DEMOREST.

Lectures and laboratory work. Practical work in the assaying of gold, silver, and lead ores, by furnace methods.

7. METALLURGICAL CONSTRUCTION. Three credit hours. Mine Engineering, fourth year, second term. *M., F., at* 10. Prerequisite, Drawing 5, Mechanics 3, Metallurgy 4 and 8. Professor LORD, Professor RAY.

Lectures and drawing-room practice in the designing of furnaces and other metallurgical machinery.

8. ORE DRESSING AND COAL WASHING. Two credit hours. Mine Engineering, fourth year, first term. *M., F., at* 10. Prerequisite, Metallurgy 4. Professor LORD.

Methods of concentrating and enriching ores and fuels by mechanical means. Lectures with references to standard books and various papers in technical journals.

9. MINERAL CHEMISTRY. Five credit hours. Short Mining, second year, third term. *M., Tu., W., Th., F., at* 8. Prerequisite, Chemistry 3. Professor LORD.

A course of lectures upon mine gases, safety lamps, mine explosions, boiler water, mine water, water supply, explosives, coal and coke.

10. METALLURGICAL PROBLEMS. Two credit hours. Mine Engineering, third year, second term. *Tu., Th., at* 10. Prerequisite, Metallurgy 4, one term. Problems and examples in general Metallurgy. Professor LORD, Assistant Professor DEMOREST.

11. ADVANCED METALLURGICAL LABORATORY. Three and five credit hours. Elective, three terms. Prerequisites, Metallurgy 2, 4, and 5, or equivalent. Mine Engineering, third year, third term. Three credit hours. *Th., F.,* 1 *to* 4. Professor LORD, Assistant Professor DEMOREST.

Laboratory work supplemented by lectures on the calorimetric and other tests of fuels, high temperature measurement, and pyrometry, microscopic examination of metals, technical analysis of flue and mine gases, the study of the properties of alloys and testing of metallurgical processes.

*12. ECONOMIC MINERALOGY. Two credit hours. Civil Engineering, fourth year, second term. Professor LORD. (Offered in 1910-1911.)

Lectures and quizzes on the elements of mineralogy with the study and identification of mineral species important for structural materials, together with their occurrence and alteration.

MILITARY SCIENCE AND TACTICS.

(Office, The Armory)

CAPTAIN GEORGE L. CONVERSE, U. S., RETIRED

The Military Department is open five days during each week of each term. Required of all students first and second year, unless excused by the Military and Gymnasium Board.

1. MILITARY DRILL. One credit hour. First and third terms. *M., Tu., W., at* 11 *or* 4.

2. MILITARY DRILL. One credit hour. Second term; Drill Regulations. *M., Tu., W., at* 11 *or* 4. Gallery Practice. *M., Tu., W., Th.,* 1 *to* 5.

MINE ENGINEERING

(Office, School of Mines Building)

PROFESSOR RAY, MR. MINOR

1. MINE SURVEYING. Five credit hours. Short Mining, second year, first term. *M., Tu., W., Th., F., at* 11. Prerequisite, Mathematics 14.

Lectures and field practice. This is similar to Course 4, but more elementary. The same text is used. The students have more practice in the drawing room.

2. VENTILATION AND HAULAGE. Five credit hours. Short Mining, second year, second term. *M., Tu., W., Th., F., at* 11. Prerequisite, Mine Engineering 1, and Physics 1.

Lectures illustrated by experiments and maps of mines and models when possible, tests by safety lamps and anemometers, and methods of air distribution in coal mines.

3. MINE OPERATING. Five credit hours, short mining, second year, third term. *M., Tu., W., Th., F., at* 11. Prerequisite, Mine Engineering 2.

---

*Not given in 1909-1910.

A course of lectures and practical instruction in mine bookkeeping and accounts, cost of working, etc., particularly adapted to Ohio coal mining.

4. MINE SURVEYING. Five credit hours. Mine and Ceramic Engineering, third year, first term. *M., Tu., Th., F., at* 10; *M.,* 1 *to* 3. Prerequisite, Drawing 33, and Mathematics 32.

Field practice in the use of instruments for surface and underground surveys. Full notes are taken and maps and plans made in the drawing room. Davies' Surveying by Van Amringe is used as a text-book.

5. MINE ENGINEERING. Five credit hours. Lectures. Mine Engineering, fourth year, first, second, and third terms. *M., Tu., W., Th., F., at* 8. Prerequisite, Mechanics 3, and Mine Engineering 4. Concurrent, Geology 2.

Mine operating, mining machinery, ventilation, shaft-sinking, workout deposits, etc. Constant reference is required to the standard works and to the leading technical journals, with practice in designing mine plants, drafting, and estimates.

6. PLANS AND SPECIFICATIONS. Five credit hours. Mine Engineering, fourth year, third term. *M., Tu., at* 10, *W., F.,* 1 *to* 4. Prerequisite, Metallurgy 7, and Mine Engineering 5.

7. SURVEYING. One credit hour. Mine Engineering, third year. Short Mining, second year, second term. Prerequisite, Mine Engineering 1 or 4.

Practical experience in surveying in some mine convenient to Columbus; the time taken in one trip not more than four consecutive days.

PHYSICAL EDUCATION FOR MEN

(Office, The Gymnasium)

DR. WINGERT, MR. KIBLER, MR. WARFIELD

1. PHYSICAL EDUCATION, consisting of a graded systematic course of healthful body-building exercise and recreation, is required two hours per week during the first year of each student's residence at the University, or until he has successfully completed three terms of this work.

All first year men are required to take a physical examination at opening of the fall term.

PHYSICS

(Office, Physics Building, Room 24)

PROFESSOR COLE, PROFESSOR THOMAS, ASSOCIATE PROFESSOR KESTER, ASSISTANT PROFESSOR EARHART, ASSISTANT PROFESSOR BLAKE, DR. BAILEY, MR. SHEARD, MR. KELLOGG, MR. BARNES, MR. NUSBAUM

1. Elementary Physics. Recitations, experimental lectures and laboratory. Text: Millikan & Gale, "Elements of Physics." Five credit hours. Short Clay-working, Industrial Arts, Mining, first year, first, and second terms. *Tu., W., Th., F., at* 11, and one three-hour laboratory period—*W., or Th.,* 1 *to* 4, *or S.,* 8 *to* 11. Prerequisite, Mathematics 14. Assistant Professor Earhart.

2. General Physics. Three credit hours, second year, three terms. Courses in Chemical Engineering, and Mining Engineering. Third term, courses in Civil and Mechanical Engineering. Lectures. *M., W., at* 9, *or Tu., Th., at* 11; also one recitation period and one two-hour laboratory period per week. Prerequisite, Preparatory Physics, and Mathematics 32. Professor Cole, Mr. Sheard, and others.

41. General Physics. Four credit hours, second year, first term. Courses in Architecture and Civil Engineering. Lectures. *M., W., at* 9, *or Tu., Th., at* 11; also two recitations and one two-hour laboratory period per week. Prerequisites, Preparatory Physics, and Mathematics 32. Professor Cole, Mr. Sheard, and others.

42. Continuation of Physics 41. Four credit hours, second year, second term. Course in Civil Engineering.

31, 32. General Physics. (Replace courses 2 and 3.) Five credit hours. Second year, first, and second terms. Courses in Ceramic, Electrical, and Mechanical Engineering, Industrial Arts, and Manual Training. Lectures. *M., W., at* 9, *or Tu., Th., at* 11; also two recitations, problems and one three-hour laboratory period per week. Prerequisite, Preparatory Physics, and Mathematics 32. Professor Cole, Mr. Sheard, and others.

33. Continuation of Physics 32. Five credit hours, third term. Course in Ceramic and Electrical Engineering, Industrial Arts, and Manual Training.

4. Electricity and Magnetism. Three credit hours. Lectures and recitations. Electrical Engineering, third year, first term. *M., Tu., Th., at* 10. Prerequisite, Mathematics 43, and Physics 31, 32 and 33. Professor Cole.

5. PHYSICAL LABORATORY. Four credit hours. Electrical Engineering, second year, third term. *M., Tu.,* 1 *to* 4; *W.,* 1 *to* 3, *or Th., F.,* 1 *to* 4; *S.,* 8 *to* 10. Option, Manual Training, third year, first, second, and third terms. *M., Tu.,* 1 *to* 4; *W.,* 1 *to* 3. Prerequisite, Physics 31, 32 and 33. Professor THOMAS, Mr. BARNES.

6. PHYSICAL LABORATORY. Five credit hours. Electrical Engineering, third year, first, and second terms. *M., Tu., W.,* 1 *to* 4, *or Th., F.,* 1 *to* 4, and *S.,* 8 *to* 11. Prerequisite, Physics 5. Concurrent, Physics 4. Professor THOMAS, Mr. BARNES.

Theory and practice of magnetic and electrical measurement, including the testing and standardizing of instruments; conductivity of conductors; insulation, capacity and resistance of insulated conductors and cables; temperature coefficients; commercial measuring and testing instruments; strength and distribution of magnetic fields; magnetic moments, permeability; photometry of gas, electric, and other lights.

7. PHYSICAL LABORATORY. Two credit hours. Mechanical Engineering, second year, third term. *M., Tu.,* 1 *to* 3, *or Th., F.,* 1 *to* 3. Three to five credit hours, first, second, and third terms. Elective. Concurrent, Physics 2.

9. PHYSICAL LABORATORY. Three to five credit hours. A second year's work in Physical Laboratory. Elective. Prerequisite, Physics 6 or 7.

ROMANCE LANGUAGES AND LITERATURES

(Office, Room 305, University Hall)

PROFESSOR BOWEN, PROFESSOR BRUCE, ASSOCIATE PROFESSOR INGRAHAM, ASSISTANT PROFESSOR PEIRCE, MR. EWINGTON, DR. FALORSI

I. FRENCH

1. ELEMENTARY FRENCH. Four credit hours. Three terms. Grammar: Fraser and Squair's, or equivalent. Reader: Aldrich and Foster's, or Bowen's First Scientific. Historical and narrative prose; one or more prose comedies. *M., Tu., Th., F., at* 10, 11 *or* 2. *Tu., W., Th., F., at* 3. All instructors in the department teach one or more sections of this course.

French 1 may be taken by students who enter with no entrance credits in French.

2. MODERN FRENCH LITERATURE. Four credit hours. *M., Tu., Th., F., at* 10. Prerequisite, Course 1, or two units entrance French. Professor BRUCE, Assistant Professor PEIRCE, Mr. EWINGTON.

The study of the literature as such now taken up. The work of the year includes the following subjects: (1) Contes; (2) The Novel (Balzac or Hugo); (3) Lyric Poetry (Bowen's Modern French Lyrics); (4) Romantic Drama (Hugo). Prose composition. Systematic attention given to syntax and idiom. Lectures supplement the work. Private reading required. French 2 should be taken by Engineering students who enter with two units entrance credit French.

3. SCIENCE READING. Four credit hours. Third term. *M., Tu., Th., F., at* 10. Prerequisite, Course 2, first, and second terms. Assistant Professor PEIRCE.

A course of rapid reading introductory to the vocabulary of scientific literature. French 3 must be taken by all Engineering students who take French 2 the first and second terms.

II. SPANISH

1. ELEMENTARY SPANISH. Four credit hours. Three terms. Grammar: (Hills and Ford's or Edgren's), and Ingraham's Victoria y Otros Cuentos. Easy prose and plays. Composition and conversation. *M., Tu., Th., F., at* 9, 11 *or* 2. Professor BOWEN, Associate Professor INGRAHAM, Mr. EWINGTON.

Spanish 1 may be taken by students who enter with no entrance credits in Spanish.

2. MODERN SPANISH LITERATURE. Four credit hours. Three terms. *Tu., W., Th., F., at* 3. Prerequisite, Course 1 or two units entrance Spanish. Associate Professor INGRAHAM.

The Modern Novel and Drama. Lectures covering a survey of the literature. Composition and conversation continued. Spanish 2 should be taken by Engineering students who enter with two units entrance credit in Spanish.

SHOP WORK

(See Industrial Arts)

SPANISH

(See Romance Languages)

GENERAL INFORMATION

THE STILLMAN W. ROBINSON FELLOWSHIP

The Stillman W. Robinson Fellowship in Engineering, endowed by Emeritus Professor Robinson for the encouragement of graduate research work in engineering, provides three hundred ($300.00) dollars annually, and is open to graduates in Mechanical, Civil, and Electrical Engineering. Any student to whom this fellowship is awarded must devote his entire time to the work, which shall amount to at least sixteen hours per week, of which at least eight shall be in the line of original research or investigation. For further information consult or address the Secretary of the Engineering College.

FEES AND EXPENSES

GENERAL CHARGES

All term dues must be paid at the opening of each term as a condition of admission to classes.

INCIDENTAL FEE—A charge of six dollars a term, or eighteen dollars a year, is made against all students, under the head of incidental expense. In the case of former students, if this fee is not paid until the second day of the term, one dollar will be added, and for each succeeding day of delinquency, fifty cents will be added.

TUITION—Tuition is free in the College of Engineering.

LABORATORY FEES—Students in all laboratory courses are required to pay a flat fee of one dollar per term for each laboratory course taken. The sums thus derived are to cover in part the loss and deterioration of the expensive instruments used by them. In addition, an effort is made in each department to assess upon the students of each laboratory course the cost of the supplies and materials consumed by them. These fees vary considerably in different departments, and they are generally collected in the form of cash advances when the student enters, the unexpended balance being returned to him at the end of the term.

In those departments where the laboratory work is chemical, the student buys a card for five dollars at the beginning of the course, and from that card is supplied with chemicals and apparatus as he needs them, the value of each purchase being punched out of the card at the time. When the card is exhausted, another must be purchased. The store room redeems all unused cards at face value. In addition a deposit of five dollars is required as security against breakage or loss of the equipment of the desks, which is not supposed to be worn out or consumed, as in the case of chemicals.

GYMNASIUM LOCKER FEE—A fee of one dollar a term is required from those who make use of a locker in the gymnasium.

CADET UNIFORMS—The uniform with which the members of the regiment are required to provide themselves costs (without overcoat) about fourteen dollars. It is quiet in pattern, and is designed to be worn in place of civilian dress.

GRADUATION FEE—A fee of five dollars, to cover expense of graduation and diploma, is required of each person receiving one of the ordinary degrees from the University, and this fee must be paid before the degree is conferred. A like fee of ten dollars is charged to each person receiving one of the higher graduate degrees.

TOTAL AMOUNT OF FEES

The element of economy on the part of the student enters somewhat into the cost of pursuing laboratory courses. For this reason it is impossible to fix accurately the costs for a term or a year. In pursuing the courses of the College of Engineering, it is not likely that a student could get through a year's work with an expenditure in fees of less than thirty ($30.00) dollars, nor is it likely that the amount would ever exceed fifty ($50.00) dollars, except in cases of fines being assessed for gross carelessness or needless destruction of property.

ROOMS AND BOARD

Boarding clubs are formed in the neighborhood of the University. Furnished rooms are rented at one dollar to a dollar and a half a week for each student, and the cost of table board is two dollars and seventy-five cents to three dollars and a half a week.

Board with furnished rooms can be obtained in private families, within convenient distance of the University, at rates varying from three and a half to five dollars per week. The ruling rate may be taken as four dollars.

ESTIMATE OF EXPENSES

	Low	*Average*	*High*
Incidental fees..........	$ 18 00	$ 18 00	$ 18 00
Laboratory fees.........	15 00	30 00	54 00
Books and stationary....	15 00	25 00	50 00
Room	35 00	45 00	75 00
Board	100 00	126 00	180 00
Laundry	10 00	20 00	30 00
Miscellaneous	10 00	30 00	75 00
Uniform	14 00	14 00	14 00
	$217 00	$308 00	$496 00

SELF SUPPORT

There is considerable amount of work upon the farm and in the shops and laboratories of the University which may be assigned to students on application. Preference is given to those studying Agriculture or one of the Engineering courses. *The University cannot promise work to all appli-*

cants. Many students find work in private families, in offices, and in various occupations, by means of which they defray at least a portion of their expenses. A person of ability and energy, who is master of a trade or who can do good work of any kind, can generally find remunerative employment. It has seldom been known that any student of ordinary energy and industry was obliged to leave the University because of a lack of money for necessary expenses, after having been sixty days on the ground—or long enough to inform himself as to the opportunities for securing employment. As an accommodation the executive office cooperates as far as possible in this matter. The Y. M. C. A. offers its services in helping young men to secure employment. Very much depends, however, on the individual's power of iniative. Students should not come to the University expecting others to find places for them. They should report to the executive office from time to time as to their needs and their work. This will enable the authorities to be more helpful than otherwise would be possible.

A student devoting much of his time to earning his way will be unable to carry successfully the full amount of collegiate work. Such students should apply for the privilege of carrying reduced work. This, of course, means that the time required to obtain a degree will be extended to five or more years, according to the amount of work successfully carried each year.

CONSULTATION—For consultation in regard to their status as members of the College of Engineering, or for the filing of petitions, changes of course, changes of class cards, adjustment of schedules and similar needs, students will apply to the Secretary, Mines Building, Room 233, from 10 to 11 a. m.

The Ohio State University Bulletin is issued at least fifteen times during the Academic year, monthly in October, November, and June, and bi-weekly in December, January, February, March, April, and May.

VOLUME XIII NUMBER 15

THE JOHN CRERAR LIBRARY

Ohio State University Bulletin

College of Engineering

Part II

March 25, 1909

PUBLISHED BY THE UNIVERSITY AT COLUMBUS
Entered as second-class matter November 17, 1905, at the postoffice at Columbus, Ohio, under Act of Congress, July 16, 1894.

THE OHIO STATE UNIVERSITY

The Ohio State University is a part of the educational system which is maintained by the State. Including certain funds received from the State and federal governments, fees, and a small amount from endowments, its annual income at present is about $700,000. This amount is expended each year upon its students and in providing buildings, equipments, and instruction. In 1908-1909 there were about 3000 students, of which nearly 33 1-3 per cent. were in the Engineering College. The University is made up of seven colleges: (1) Agriculture and Domestic Science, (2) Arts, Philosophy, and Science, (3) Education, (4) Engineering, (5) Law, (6) Pharmacy, and (7) Veterinary Medicine. The University is located in Columbus, about two miles north of the Union Station.

Calendar. The regular courses of the University are divided into three terms of about three months each. These begin for the year 1909-1910 on September 21, 1909, January 4, 1910, and April 6, 1910. The third term ends June 22, 1910. There is also a Summer Term, beginning June 21, 1909, and ending August 19, 1909. The regular time for entering the University is in September, but students may be admitted at the beginning of any term.

Bulletins describing in detail the work of any of the Colleges of the University may be obtained by addressing The University Editor, Ohio State University, Columbus, Ohio.

This is Part II of the Engineering College Bulletin, and gives a general description of the work of the College. Part I of this Bulletin, which gives detailed descriptions of all courses given in this College, may be obtained by addressing The University Editor, as above.

THE COLLEGE OF ENGINEERING

One of the most remarkable developments of the past generation has been that of engineering as a profession. Thirty years ago the number of engineering colleges in the country could have been counted upon the fingers of one hand, and the number of those who would now rank as competent engineers could probably have been represented with a figure of two digits. Now there are in the neighborhood of fifty engineering colleges of high standing, and the number of men in the United States with engineering degrees runs far into the thousands. This development has gone hand in hand with the great industrial development of the country, and its relationship has been both that of cause and of effect. While there are many men doing good work in connection with the manufacturing and engineering professions who have not received the technical training given at the colleges, their number is relatively decreasing, and it is becoming more and more difficult for a young man to work up along these lines without the advantage of a college course. For most positions of responsibility a man must have essentially the fitting which is obtained at college, and if he does not get it there, he must get it by hard work in other ways. Many of the large manufacturing and railway companies now give decided preference to technically trained men for positions of responsibility.

From the pages that follow may be learned the kind of work for which the different engineering courses prepare their graduates, but a few general statements here will not be out of order. The College does not claim to produce finished and experienced engineers, but it does give the kind of training which is considered best not only by the men in the closest touch with the problems of technical education but also by those engaged in the high-grade engineering work. This training gives the student an experience and a facility in the solution of practical problems which enable him to acquire quickly such an insight into the detailed methods of a business as will fit him to take a responsible position.

It is, of course, impossible to train men to become successful engineers unless they possess natural talents for that class of work. In general, these are indicated by a liking for mathematics and the applied sciences of chemistry and physics; also by an interest in the use of tools, in drawing, and in practical construction. Every year many persons who are not naturally fitted to be engineers enter the colleges because they believe that engineering pays. As in every other profession, a man's success depends largely upon his native adaptability to his particular line of work, and it is very seldom that one who has not shown natural inclinations along the lines indicated above makes a capable engineer. On the other hand, to the man who has the talent for this work, it is doubtful whether there is any profession that will give better satisfaction or remuneration.

In general, the positions filled by the graduates of the Engineering College may be classed as lying in the fields of development, operation, and commerce. Under development come those positions which deal with the invention, design, and construction of machines, engineering works and enterprises; under operation are classed such positions as superintendents and managers of manufacturing establishments, power plants, railways, and similar undertakings; under commerce, are positions dealing with the sale of machinery, power, transportation, etc. This latter field deserves special mention, because the engineering course is not usually thought of as preparing for it. It is, however, true that a large and an ever increasing number of manufacturing and operating companies are coming to regard the engineering college training as the best that can be had for the men who are to act as their salesmen and commercial managers. The combination also of the engineering and commercial training, together with a natural fitness for executive work, gives the ideal preparation for the higher executive offices of large enterprises.

The success of the course of training offered by the College is testified to by the very large percentage of the graduates who are engaged in occupations connected with engineering. A study of recent records indicates that of the 771 graduates of the College over ninety-six per cent. are now engaged in work for which their engineering training has especially fitted them. The following is a summary of the graduates from the different courses, together with the designations of degrees given and the years in which the degrees were first conferred:

SUMMARY OF GRADUATES

Architecture (C. E. in Arch.)	1903	7
Ceramics (Cer. E.)	1900	25
Chemistry (B. Sc. in Chem.)	1899	37
Civil Engineering (C. E.)	1883	210
Electrical Engineering (M. E. in E. E.)	1891	222
Industrial Arts (B. Sc. in Ind. Arts)	1897	5
Mechanical Engineering (M. E.)	1880	168
Mine Engineering (E. M.)	1880	103
Master of Science, Conferred by College of Engineering		2
Total Degrees Conferred		779
Names Counted Twice		8
Total Number of Graduates		771

COURSES OFFERED. Courses are offered in the departments of Architecture, Industrial Arts; Ceramic, Chemical, Civil, Electrical, Mechanical, and Mine Engineering, leading respectively to the degrees of Civil Engineer in Architecture, Bachelor of Science in Industrial Arts, Ceramic Engineer, Bachelor of Science in Chemical Engineering, Civil Engineer, Mechanical Engineer in Electrical Engineering, Mechanical Engineer, and Engineer of Mines. Besides the fourteen departments the equipment of which is described in the following pages, the departments of Economics, Germanic Languages, Mathematics, Military Science, Physical Education, and Romance Languages take part in the work of this College. There are altogether 113 professors and assistants who give the instruction. Opportunity is also offered to take elective work in any of the forty-five departments of the University. The University Library of about 82,000 volumes is accessible to the students and includes the most important books in the different fields of engineering.

EXPENSES. The following cover all charges payable to the University. The amounts are per term. Tuition is free. Incidental fee, $6.00; each laboratory or drawing course, $1.00; gymnasium fee (for use of locker, optional), $1.00; a deposit, from which is deducted the cost of material used or injured in the laboratories, $2.00 to $10.00. There is also a graduation fee of $5.00 at the end of the course. These payments need seldom exceed

$35.00 per year. In addition to these, the expenses for military uniform and necessary books, etc., will range from $30.00 to $40.00. The other expenses incident to living at Columbus will bring the total cost per year, exclusive of other clothing, up to from $225 to $400, according to the degree of economy exercised by the student. Board and room, included in the above, will range from $4.00 to $6.00 a week.

THE STILLMAN W. ROBINSON FELLOWSHIP. This Fellowship in Engineering, endowed by Emeritus Professor Robinson for the encouragement of graduate research work in engineering, provides three hundred dollars annually, and is open to graduates in mechanical, civil, and electrical engineering. All applications must be filed on or before the fifteenth of March.

BROWN HALL

SELF-SUPPORT. Many students pay part of their expenses by doing outside work during their course. During most of the year students can obtain work at a rate of 15 cents an hour or more, according to the character of the work and their expertness in it. An employment bureau at the University Y. M. C. A. assists students in obtaining work. Persons of ability and energy who are masters of some trade can generally find employment at good wages. It should be especially noted, however, that work cannot be promised to all applicants, and in particular that no student should come to the University without the means of defraying his expenses for at least the first term. During the first few weeks there are many more applicants for work than later on, and, although the University authorities are glad to do what they can to assist students in these matters, responsibility for finding work rests entirely with the individual. It is strongly advised that students who have to defray a considerable part of their expenses by their own efforts arrange to take less than the regular work of the course, thus extending the course to five or more years.

Financial Assistance. There are certain endowments which provide funds to be loaned without interest to students who are working their way through college. The amount of these funds is limited, and preference is given to men who have already shown by their own exertion that they are in earnest in their efforts to get an education.

SCHOOL OF MINES BUILDING

Consultation. It is the desire of the officers and faculty of the Engineering College to render all needed assistance to students of the College in the prosecution of their work, and all students who feel the need of consultation or advice, are invited to call upon the Dean or Secretary of the College, or upon any of the instructional force at their respective offices. The Secretary can be found at Room 233 of the Mines Building, daily from 10 to 11.

GROUNDS AND BUILDINGS

The grounds of the University are located about two miles north of the Union Station and reach west from High street past the extension of Neil avenue. They may be reached by the car lines on either of these streets. The campus proper is approximately one-half mile wide by two-thirds of a mile long. To the west of this is the University farm, which, combined with the campus, has an area of 439 acres. As seen from the map on the back inside cover, the twenty-nine larger buildings, valued at over one and a quarter million dollars, are irregularly arranged near the center of the campus, leaving a roughly quadrangular open space in the center. Three of the buildings, Brown Hall, the School of Mines, and the Engineering Laboratory, are occupied entirely by the work of the Engineering College and are located near each other and near the power plant in the northwestern portion of the grounds. Besides these, five other buildings described below are largely used by the students of this college.

A bulletin of views of some of the buildings and interiors may be had by addressing the University editor.

BROWN HALL. Of the three buildings which are entirely occupied with the work of the college, the oldest is Brown Hall, a light brick structure named after the former Dean of the College. This was completed in 1904 at a cost of $75,000. The main part of this building is 217 by 50 feet and there are two short wings extending to the rear. The high basement is mostly used for laboratories, while the lecture and drawing rooms are situated in the first and second stories. Large windows throughout the building furnish excellent illumination. This building accommodates the departments of architecture, civil engineering, and engineering drawing. (See also pages 18, 28, and 43.)

THE SCHOOL OF MINES. This building was completed in 1906, and cost $85,000. It is 270 feet long by 70 feet wide with two one-story fireproof wings for the accommodation of furnace work. The basement which is mostly above grade is used for laboratories, store rooms, etc. There are also a number of laboratories on the first floor, and lecture rooms, drawing rooms, offices, etc., on both this and the second floor. The departments of ceramic engineering, metallurgy, mechanics, and mine engineering occupy this building. (See also pages 21, 39, 42, and 44.)

The Engineering Laboratory. This is a building of modern shop construction with sawtooth roof, made up of one forty-eight-foot and seven thirty-foot divisions. These, together with enclosed galleries at the sides, make a total length of 310 feet, with a depth of 112 feet. The enclosed galleries and the space under them are used for special laboratories, museums, class rooms, and offices. The central sections are each lighted by skylights with northern exposure, and are occupied by the different laboratories of the mechanical and electrical engineering departments and by an amphitheatre suitable for demonstration work which is used by both departments. This building, which has just been completed, cost $75,000, exclusive of equipment, and is one of the most practical laboratory buildings in the country. (See pages 30 and 36.)

ENGINEERING LABORATORY

Hayes Hall. This building was named after President Hayes, who was at one time a trustee of the University. It is at present partially occupied by the department of industrial arts, which includes all the shop work given to the students of the College. This building, which was completed in 1893, is irregular in shape, with a frontage of 166 feet and greatest depth of 144 feet. A central wing is occupied by the machine and carpenter shops, foundry, and forge room, while the offices and drawing rooms occupy a portion of the front of the building. The shop equipment is given on page 34.

Chemistry Hall. Chemical Engineering, as well as the other work of the department of Chemistry is carried on in this building, which was completed in 1907, at a cost of $100,000. It has a frontage of 220 feet and a depth of 70 feet, with laboratories, lecture rooms, offices, etc., occupying two stories and a high basement. (See also Chemical Engineering.)

PHYSICS HALL. This building is devoted to the work of the Physics Department. It is 105 feet long by 102 feet in its greatest depth, with three stories and a high basement. It was recently erected at a cost of $80,000, and has a very fine equipment. A large part of the basement is given to the laboratory work in electrical measurements. (See also page 47.)

OBSERVATORY. The Emerson McMillin Observatory is the gift of Emerson McMillin of New York City. It is located in the southern part of the grounds on a slight hill, and is provided with a large dome for the twelve-inch telescope. (See also page 45.)

ORTON HALL. This building is of white sandstone and of fireproof construction. It was built for the Department of Geology for which it is well adapted. At present the University Library and reading room are also temporarily located here. For the equipment of the Geological Department, see page 45.

UNIVERSITY HALL. In this building which is the oldest on the grounds, the work in mathematics and language is for the most part given. This building also contains the offices of the President and of the Secretary of the Board of Trustees.

POWER HOUSE. The University provides its own light, heat, and power for all the buildings from a central station. There is a boiler house 38 by 100 feet, with five 150 horse-power boilers, equipped with automatic stokers and with coal and ash handling apparatus. Near the boiler house is the power house, forty by sixty feet, equipped with two 125 kilowatt two-phase direct connected steam units, one sixty kilowatt belted unit, and one 100 kilowatt gas engine unit. The power and boiler houses are connected through a large tunnel with nearly all the buildings of the University, and through this tunnel run the pipes for steam, water, and gas, as well as the electrical distribution system for light and power.

DEPARTMENTS, FACULTY, AND INSTRUCTORS

WILLIAM OXLEY THOMPSON, D. D., LL. D., President of the University.

CARL E. STEEB, B. Ph., Secretary of the Board of Trustees.

FRANCIS CARY CALDWELL, B. A., M. E., Dean of the Engineering College.

JAMES E. BOYD, B. Sc., M. Sc., Secretary of the Engineering College.

EDITH D. COCKINS, B. A., Registrar.

OLIVE BRANCH JONES, B. A., Librarian.

ARCHITECTURE

JOSEPH NELSON BRADFORD, M. E., Professor.
CHARLES ST. JOHN CHUBB, C. E. (Arch.), Associate Professor.
F. H. HASKETT, Instructor.

ASTRONOMY

HENRY CURWEN LORD, B. Sc., F. R. A. S., Professor.
EDMUND S. MANSON, JR., S. M., Assistant Professor.

CERAMIC ENGINEERING

EDWARD ORTON, JR., E. M., Professor.
ROSS C. PURDY, Cer. E., Associate Professor.
WOLSEY GARNET WORCESTER, Instructor.

CHEMISTRY

WILLIAM MCPHERSON, D. Sc., Ph. D., Professor.
SIDNEY AUGUSTUS NORTON, Ph. D., LL. D., Emeritus Professor.
WILLIAM EDWARDS HENDERSON, Ph. D., Professor.
CHARLES WILLIAM FOULK, B. A., Professor.
WILLIAM LLOYD EVANS, Ph. D., Associate Professor.
JAMES RENWICK WITHROW, Ph. D., Assistant Professor.
CLARENCE CHARLES VOGT, B. A., Instructor.
SAMUEL MORRIS, M. A., Instructor.
WALTER J. SALE, B. A., Assistant.
HOWARD J. LUCAS, M. A., Assistant.

CIVIL ENGINEERING

Christopher Elias Sherman, C. E., Professor.
Frank Harvey Eno, B. S., C. E., Professor Municipal Engineering.
Clyde T. Morris, C. E., Professor Structural Engineering.
Roy K. Schlafly, C. E., Assistant Professor.
John Ross Chamberlin, Assistant Professor.
Kenneth Baker Ward, C. E., Assistant.
Clifford Shoemaker, C. E., Assistant.

ELECTRICAL ENGINEERING

Francis Cary Caldwell, B. A., M. E. in E. E., Professor.
John Herman Hunt, B. S. in E. E., Associate Professor.
Walter Lyman Upson, M. S., M. E. E., Assistant Professor.
Leroy W. Roush, M. E. in E. E., Fellow.

ENGINEERING DRAWING

Thomas Ewing French, M. E., Professor.
Thomas Kenyon Lewis, B. Sc., Assistant Professor.
Ralph Rogers, B. S. E. E., Assistant Professor.
Robert Meiklejohn, M. E., Assistant Professor.
George Robert Bott, M. E., Instructor.
John Satterlee Tidball, B. S., Instructor.
W. J. Norris, Instructor.

ENGLISH

Joseph Villiers Denney, B. A., Professor.
Joseph Russell Taylor, M. A., Professor.
George H. McKnight, Ph. D., Professor.
William Lucius Graves, M. A., Associate Professor.
Carson Samuel Duncan, M. A., Assistant Professor.
Charles E. Blanchard, LL. B., Assistant Professor.
Louis Albion Cooper, B. A., Assistant Professor.
Walter Larabee Leighton, Ph. D., Assistant Professor.
Archibold Mowbray Burnham, M. Ph., Assistant Professor.
Edwin Long Beck, B. A., Instructor.

GEOLOGY

Charles Smith Prosser, D. Sc., Ph. D., Professor.
John Adams Bownocker, D. Sc., Professor.
George David Hubbard, Ph. D., Assistant Professor.
William Clifford Morse, M. A., Instructor.

GERMANIC LANGUAGES AND LITERATURES

LEWIS ADDISON RHOADES, Ph. D., Professor.
BERTHOLD AUGUST EISENLOHR, M. A., Associate Professor.
MAY THOMAS, Ph. D., Assistant Professor.
ADOLPH BUSSE, Ph. D., Assistant Professor.
ROBERT OSCAR BUSSEY, M. A., Instructor.
SARAH TRACY BARROWS, M. L., Instructor.

INDUSTRIAL ARTS

FRANK EDWIN SANBORN, S. B., Professor.
WILLIAM ABNER KNIGHT, M. E., Assistant Professor.
CHARLES PHILIP CROWE, Instructor.
CLEMENT M. BEEM, Instructor.
ALLANDO CASE, Instructor.
ULYSSES W. DENMAN, Assistant.

MATHEMATICS

ROSSER DANIEL BOHANNAN, B. Sc., C. E., E. M., Professor.
GEORGE WASHINGTON MCCOARD, M. A., Professor.
KARL DALE SWARTZEL, M. Sc., Professor.
HARRY WALDO KUHN, Ph. D., Professor.
CHARLES LINCOLN ARNOLD, M. Sc., Associate Professor.
SAMUEL EUGENE RASOR, S. M., Associate Professor.
JOHN BOWKER PRESTON, M. A., Assistant Professor.
GRACE MARIE BAREIS, B. A., Assistant Professor.
CHARLES CLEMENT MORRIS, M. A., Assistant Professor.

MECHANICAL ENGINEERING

WILLIAM THOMAS MAGRUDER, M. E., Professor.
EMBURY ASBURY HITCHCOCK, M. E., Professor.
HORACE JUDD, M. E., M. Sc., Assistant Professor.
CARL RIGDON, M. E., Assistant Professor.
CHARLES SUMNER FISHER, M. E., Assistant.
JAMES PARK CALDERWOOD, M. E., Fellow.

MECHANICS

JAMES ELLSWORTH BOYD, M. S., Professor.
EDWIN F. CODDINGTON, C. E., Ph. D., Associate Professor.
CLAUDE VICTOR BUCHER, C. E., Assistant.

METALLURGY AND MINERALOGY

NATHANIEL WRIGHT LORD, E. M., Professor.
*EDWARD ELSWORTH SOMERMEIER, G. Ph., Associate Professor.
DANA JAMES DEMOREST, B. Sc. (Chem.), Acting Assistant Professor.

MILITARY SCIENCE AND TACTICS

GEOGRE L. CONVERSE, U. S. A., Ret., Professor.

MINE ENGINEERING

FRANK ARNOLD RAY, E. M., Professor.
WELLS H. MINOR, E. M., Assistant.
HARRY NOLD, Student Assistant.

PHYSICAL EDUCATION FOR MEN

H. SHINDLE WINGERT, M., D., Director.

PHYSICS

ALFRED DODGE COLE, M. A., Professor.
BENJAMIN FRANKLIN THOMAS, Ph. D., Professor.
FREDERICK EDWARD KESTER, M. E., Ph. D., Associate Professor.
ROBERT F. EARHART, Ph. D., Assistant Professor.
FREDERICK COLUMBUS BLAKE, Ph. D., Assistant Professor.
CHARLES SHEARD, M. A., Instructor.
FRANK KELTON BAILEY, Ph. D., Instructor.
DAVID RAYMOND KELLOGG, B. Sc., Assistant.
CHRISTIAN NUSBAUM, B. A., Assistant.
ALFRED HENRY BARNES, M. E. in E. E., Assistant.

ROMANCE LANGUAGES AND LITERATURES

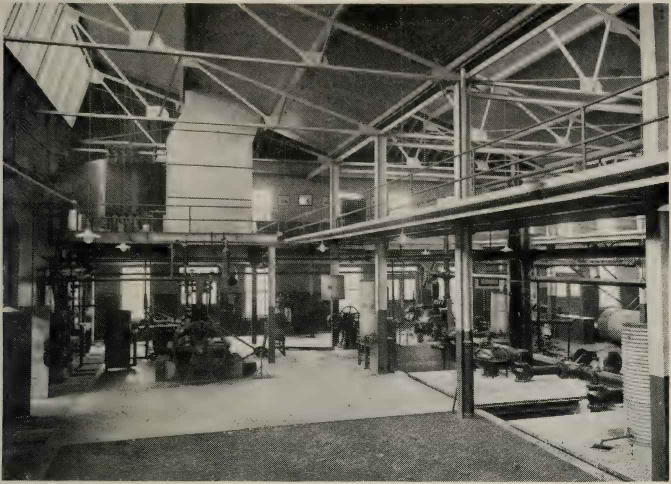
BENJAMIN LESTER BOWEN, Ph. D., Professor.
CHARLES A. BRUCE, B. A., Professor.
EDGAR SHUGERT INGRAHAM, Ph. D., Associate Professor.
WALTER THOMPSON PEIRCE, Ph. D., Assistant Professor.
ALFRED EWINGTON, M. A., Instructor.
VITTORIO FALORSI, D. L., Instructor.

ROBINSON FELLOW IN ENGINEERING

GERALD PIERCE LAWRENCE, M. E.

---

*Absent on leave, 1908-1909.



MECHANICAL ENGINEERING LABORATORY

ELECTRICAL ENGINEERING LABORATORY

ADMISSION

A separate bulletin giving full detailed information with regard to entrance requirements may be had by writing to the University Editor, Ohio State University, Columbus, Ohio. The Entrance Board has entire charge of the admission of students, and determines the credits to be issued on all entrance examinations and certificates. They furnish all desired information to applicants, and all further correspondence relating to admission credits should be addressed to them.

ADMISSION TO REGULAR FOUR-YEAR COURSES. An applicant must be at least seventeen years of age, and his preparation must include English, history, mathematics, science and foreign language, as prescribed in the Entrance Bulletin mentioned above. This preparation may be obtained in all of the best high schools of the State. The University visits and inspects the high schools of Ohio and publishes in the Entrance Bulletin a list of schools the graduates of which may enter the University without examination in all subjects for which they have approved credentials. All other applicants except for special, summer, and short courses, must pass entrance examinations given at the University in June and September.

ADMISSION WITH ADVANCED STANDING. The College is glad to receive graduates and students from other colleges and a liberal policy in regard to credit for work done elsewhere is followed. See Entrance Bulletin.

ADMISSION TO SPECIAL STUDIES. Under restricted conditions, students are admitted to take special courses. Most of the entrance requirements may be waived in the case of applicants for such special studies who are at least twenty-one years of age. See Entrance Bulletin.

ADMISSION TO SHORT COURSES. Unless over twenty-one years of age, applicants must pass examinations in arithmetic, geography and simple composition, or must present certificates. An applicant under twenty-one must present a letter or certificate showing that he has had at least one year of practical experience in some industry related to the course which he wishes to pursue. See Entrance Bulletin.

Admission to Summer Courses for Artisans. There are no specified requirements for admission to these courses, but applicants must show that they have had such training or experience as will qualify them to take profitably the courses they desire. A small amount of the elements of algebra is very desirable, especially for the courses in Mechanical and Electrical Engineering. See Artisan Course Bulletin.

FORGE SHOP—HAYES HALL

THE COURSES

The object of the principal or four-year courses is to fit men to take positions of large responsibility in the industrial work of the times. A man's value is measured in most cases by his ability to handle large enterprises and direct the work of other men. The training for such work requires a broad foundation. The laying of this is started in the schools, and its further building fills up nearly the whole of the first year's work in college. The work of this year is the same for all courses.

As befits its importance to the engineer, mathematics forms the backbone of the courses, extending as a solid five-hour course from the time the student enters up to the end of the second year. Algebra, trigonometry, and analytical geometry in the first year, and calculus throughout the second form the basis for much of the technical work and especially for the work in mechanics. This may be said to continue the mathematical series through the third year.

Modern language which should, if possible, have been studied for at least two years before entering, is an important study, though it is not required beyond the first year. It may be either German, French or Spanish, though if one of these has been begun before entering college it must be continued. Too much emphasis cannot be laid upon the importance to the engineer of the study of English as a tool for use in his dealings with other men; and this study also is in general confined to the first year.

Next to mathematics, chemistry and physics form the most useful sciences to the engineer. General chemistry and qualitative analysis constitute nearly one-fourth of the work of the first year, while physics occurs in the second year of all courses. In both chemistry and physics, laboratory work is an important accessory to the lectures and recitations.

Drawing is the graphical language of the engineer. Mechanical drawing and projections are carried through the first year. In the second year the drawing is continued as descriptive geometry for two terms, and machine sketching in the third. In architecture there is a special series of drawing courses after the first year.

Military drill is required in the first and second year and gymnasium in the first, except for a few who for various reasons are excused. The remaining work given diverges in the different courses and will be found described in the following pages under the various departments.

TWO-YEAR AND SUMMER COURSES

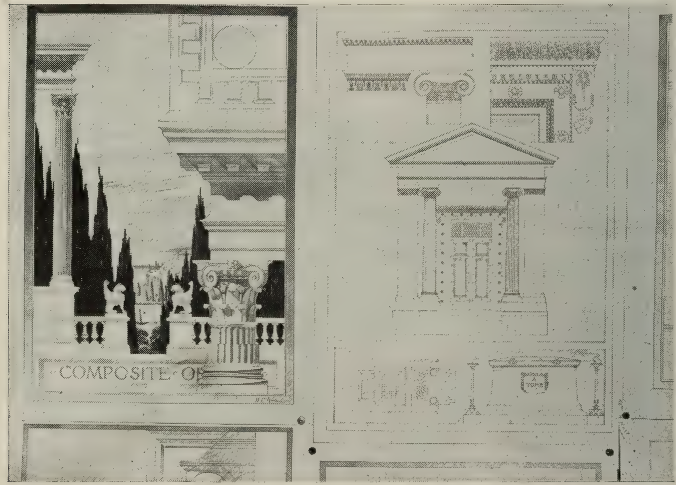
The University recognizes the existence of a large class of young men who are for the most part already engaged in the various industrial lines, and who through lack of preparation or funds are unable to avail themselves of the opportunities in the regular courses. For such men the short courses in clayworking, industrial arts, and mining, and the artisan courses in drawing, electrical and mechanical engineering, and shop-work have been arranged. For both of these groups of courses the entrance requirements are of the lowest (see under admission above), and the work given is elementary in character and very practical. Certificates are given showing the work accomplished.

THE SHORT COURSES require two years for their completion, though if obliged to do so, the student may drop the work at any point. As no algebra, geometry, or trigonometry are required for entrance, and as these subjects are essential to any understanding of even the simplest problems in engineering, about two-thirds of the first year in all short courses is devoted to them. A year of mechanical drawing is also given and two-thirds of a year in elementary physics. The remaining studies differ and are described under the headings of ceramic engineering, industrial arts, and mine engineering. If, previous to entrance, the student has made a sufficient study of any of the subjects in these courses, he may be permitted to substitute more advanced work.

THE ARTISAN COURSES are given during the summer term from June 21st to August 13th. The courses in mechanical and electrical engineering and drawing are given during the first four weeks and the shopwork courses during the second four weeks of the term. These courses are intended for all sorts of practical workers in mechanical and electrical lines. Each of the courses given and described under the headings of engineering drawing, electrical and mechanical engineering and industrial arts is open to any one whose previous training or experience has been such that he would profit from the matter given. In these courses lecture and laboratory work are carried along together in such a way that the student has an immediate opportunity to test for himself in the laboratory the facts presented to him in the lectures. In this work he has the same machinery and apparatus that is used by the regular engineering students, and does the work under the direction of the same instructors. The work, however, is simplified and adapted to the needs of those who take it.

Tuition is free, but an incidental fee of six dollars a term is charged each person taking one or more courses. A deposit of three dollars is required for each course in shopwork to cover the cost of materials used.

For detailed information concerning the artisan courses send for "The Artisan Course Bulletin," addressing The University Editor, Ohio State University, Columbus, Ohio.



ARCHITECTURAL DESIGNS (SECOND YEAR WORK)

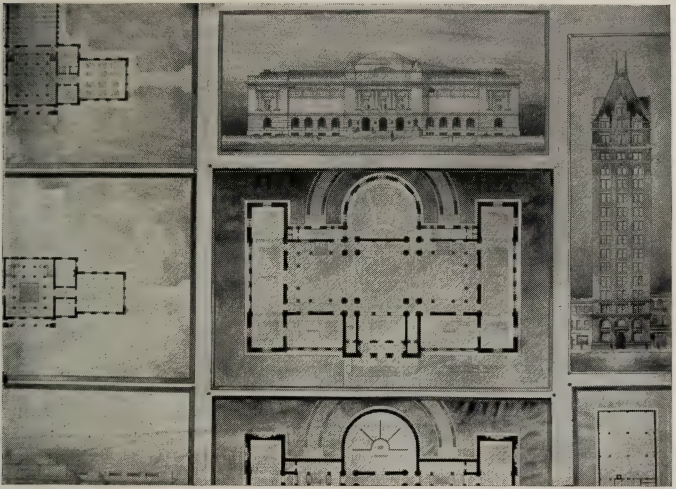
ARCHITECTURE

(See Part I for more detailed statement.)

To the young man with artistic taste and talents, and who at the same time has an interest in practical constructive problems, the work of the architect will appeal as a vocation. Architecture perhaps brings its practitioner into closer touch with every day life than any other profession, and it offers a wide field for advancing the general good of the community. The character of buildings to be seen on every hand emphasizes the need of education in architecture in respect both of design and of construction.

Quarters and Equipment. The department occupies the west end of Brown Hall (see page 6), where it is provided with large, well lighted designing rooms, a lecture room with projection lantern, library, and office.

In the designing rooms, each student is provided with a drawing table and locker for his exclusive use. The equipment consists of drawing tables, a fine collection of plaster casts of architectural orders, carved ornament and statuary, photographs, lantern slides, architectural plates, drawings and specifications of erected structures, samples of building materials, etc. The library has a well selected collection of standard architectural works for every day reference. Among the various items of special interest in these collections, the following may be noted: A fine collection of Caproni plaster casts from the noted monuments of ancient and mediæval architecture, two thousand lantern slides of the masterpieces of architecture, collection of large photographs, a fine collection of noted portfolios of architectural plates, and the library collection of standard works and bound volumes of the standard periodicals.



ARCHITECTURAL DESIGNS (FOURTH YEAR WORK)

Photographic Laboratory. The courses in photography are given in this department. The laboratory for this work is one of the best in the country and includes a dark room which will accommodate comfortably forty students working at the same time, each with a complete and separate stall. There are also a printing and toning room and a room for indoor and special work. Equipment of note consists of fourteen high-grade view cameras fitted with fine lenses, also shutters, color screens, and exposure meters, a Bausch and Lomb photo-micrographic apparatus of the finest quality, and special photographic arc lamps. Under the charge of this department is a special blue-printing room, equipped with a modern cylindrical arc lamp, blue-printing machine, also washing tanks and a drying rack.

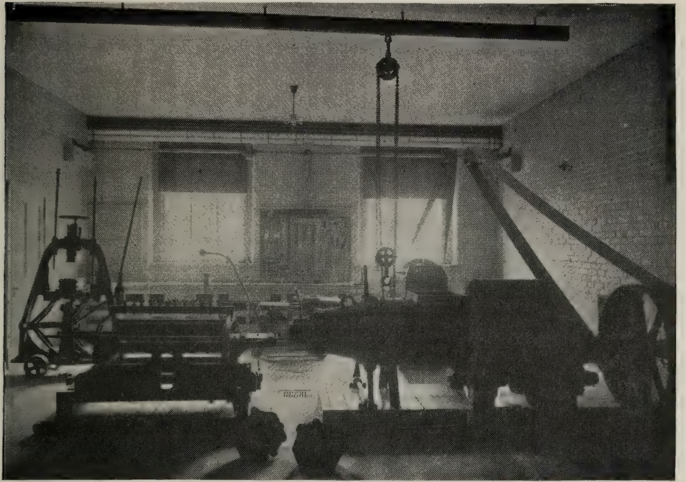
THE COURSE. The special architectural work of the course commences in the second year with history of architecture which affords instruction in the principles governing design in classic, mediæval and renaissance work, and the proper use to be made of precedent. The history of architecture is accompanied by a course in drawing and design devoted to the "orders" and "order problems." Courses involving class and drawing room work are given during this year in shades and shadows, architectural perspective, and stereotomy.

Throughout the third and fourth years practical designing courses are given, which include problems relating to residences, apartment houses, school buildings, public buildings, tall steel constructed office buildings, and ecclesiastical structures. Decoration, architectural composition, working drawings, and structural details are covered in separate courses during the third year, while monumental design, specifications, estimating, sanitary plumbing, and professional practice are studied in the fourth year.

Drawing, both freehand and mechanical, is very essential to the architect. Thus in addition to the extensive practice which the student gets in his designing, a series of courses in drawing and allied subjects runs through most of the four years. This commences with four weeks in the summer at the end of the first year, devoted entirely to freehand drawing and descriptive geometry, and extends through the second year as charcoal and pen work, and through the third as photography, water color, and clay modeling. In the fourth year, a course in charcoal drawing from the antique and from life completes this series.

On the structural side a course on the design of trusses takes the place of the third term mechanics as given in the other courses. Along the same line there are in the last years, courses in cement work, masonry, steel construction, reinforced concrete, and surveying. Work in the testing of materials and in heating and ventilating is also given. A thesis, usually the complete plans and specifications for some important structure, is required before graduation.

GRADUATES. The following positions are now held by graduates of this department and indicate the character of work for which the course prepares: Members of architectural firms, chief draftsmen in architectural offices, architect for an interurban railway constructing firm, architectural structural steel designers, and draftsmen in architectural offices.



BRICKMAKING MACHINE—CERAMIC LABORATORY

CERAMIC ENGINEERING

(See Part I for more detailed statements.)

The ceramic industries include those in which the production and utilization of natural and artificial silicates is the end in view; viz., clayware, glass, and cement. These three industries constitute a natural division of chemical technology.

Ceramic engineering is the application of chemistry and engineering to this group of non-metallic mineral industries. The ceramic engineer should be enough of a geologist to determine whether a tract of country possesses minerals suited to silicate manufacture, and enough of a mine engineer to economically win the deposits found, whether they are to be quarried or mined. He must be enough of a mechanical engineer to successfully direct the necessary transportation, preparation, and manufacture of these materials. Above all, he must be enough of a chemist to understand the processes taking place in kilns and furnaces, both as regards the generation of heat, and the formation of new silicate minerals from the earthy raw materials. The intimate relation existing between the composition and properties of silicate products throughout all ceramic operations, and the use of chemical control for maintaining these relations constant, make the training of the chemical laboratory absolutely necessary to the safe and progressive management of any modern ceramic industry.

KILN ROOM—CERAMIC ENGINEERING

The Department of Ceramic Engineering occupies the western third of the School of Mines Building. In the basement are a pottery laboratory, a brick machine room, and a room chiefly devoted to the grinding of dry materials. There is also a large store room, and in an attached fireproof wing a finely equipped kiln room. On the first floor, besides offices and class rooms, there is a chemical laboratory and a museum of ceramic products and experiments. On the second floor are rooms for physical testing and measurement, advanced thesis work, offices, and class rooms.

Among the items of particular interest in the equipment may be mentioned a fine collection of clays from Ohio and other parts of the United States, used for laboratory material in clay testing, a good collection of lantern slides illustrating the occurrence, winning, manufacture, and burning of clay, a work room with large, roomy lockers for each pair of men, by means of which each student's work can be kept safe and under his own control. There are also excellent provisions for all the mechanical process of preparation, manufacture, and burning.

The Course. In the second year there is a particularly strong course in physics. In the same year, technical work in ceramics begins with a laboratory course running through the year, dealing with the chemical analysis of the various materials used in the ceramic industries. During the last term this is accompanied by a course in ceramic calculations. In the third year this work is continued by a course of lectures through the three terms, which cover the winning of the raw materials, their preparation and manufacture, and the drying, burning, and decoration of the ceramic products. There is also a short laboratory course on the identification and classification of clays and other raw materials, and lecture and labortory courses of one term each on physical chemistry and its application to the ceramic industries. In the fourth year, laboratory courses on the manufacture of ceramic bodies, the production of glasses and glazes, and the production of enamels and colors continue the ceramic training. However, a course on cement manufacture may be elected in place of the course on enamels and colors. In this year there is also a course on the drawing and design of ceramic structures.

There are also courses distributed through the third and fourth years on the metallurgy of fuels and iron, geology, general and economic, petrography, design of trusses, mechanism, mine surveying, photography, and steam engines and boilers. The last three consist largely of laboratory work. As a requisite to graduation, a short thesis on some original work along ceramic lines is required.

The Short Course in Clayworking is one of those described on pages 17 and 18. In addition to the subjects there given, the work of the course may be described as follows: In the first year there is lecture and laboratory work in inorganic chemistry and qualitative analysis. In the second year the ceramic work proper begins with a lecture course on the winning of the raw materials, their preparation and manufacture, and the drying, burning, and decoration of the ceramic products. Running along with this there is laboratory work in the chemical analysis of ceramic materials and in the manufacture of ceramic bodies, glazes, and colors. There is also a course in the working problems in ceramic chemistry.

This course is designed only for persons who already have considerable experience in clayworking operation.

WORK OF GRADUATES. To give an idea of the kind of positions held by the graduates from this course after they have been out of college for a few years, the following classification of positions now held by men who have been out three or more years is given: Experts in charge of manufacture of insulator goods, 5; teachers of ceramics, 4; government service, 2; superintendent of brick plants, 15; superintendent or technical expert of terracotta plants 10; superintendents of potteries, 4; technical men in potteries, 2; managers and owners of brick plants, 3; technical men in abrasive wheel manufacture, 3; superintendent of sewer pipe plants, 3; cement chemists, 2; enameled ware chemists and superintendents, 2; general or analytical chemists, 1.

LECTURE ROOM—CHEMICAL ENGINEERING

CHEMICAL ENGINEERING

(See Part I for more detailed statements.)

The course in Chemical Engineering has been prepared to meet the growing demands for trained men in the numerous industries which employ chemical processes prominently in their work, and which are not included in the fields of metallurgy and ceramics. Among such may be mentioned the manufacture of acids, alkalies, salts, chemical reagents, paints, colors, dyes, bleaching powders, soaps, glue, gelatin, glycerine, tanning compounds, starch, sugar, dextrine, glucose, alcohol, ferments, preservatives, antiseptics, fertilizers, matches, and many others.

Much of this work has been done in the past without the aid of the chemist. At present it is recognized, however, that in order to carry on the work economically and compete with other countries, the services of the chemist are indispensable. Not only is he able to improve the methods and obtain better products, but he is often able to devise means for utilizing the by-products and thus lower the cost of production.

Quarters. The Department of Chemistry occupies the greater part of Chemistry Hall, a description of which will be found on page 7. In the basement are two laboratories, each accommodating 400 students in elementary chemistry. There are also laboratories for industrial chemistry, and for organic combustion work, and a carpenter shop. On the first floor are the main office of the department, a large laboratory for organic chemistry accommodating seventy-five students, a smaller one for research work, a lecture room, a library, and a main store room where all the supplies of the department are kept in stock.

On the second floor is the main lecture room, having a seating capacity of 300, and equipped with lantern, specimens, etc., for demonstration work. On this floor are laboratories for the following lines of work: Physical chemistry, general analytical work, advanced inorganic chemistry, and the chemical investigation of water. There are also three small private laboratories, the balance room, a small lecture room, and the electrical room, containing the storage batteries, a mercury converter and switch board. On the upper floor are three recitation rooms. The apparatus for ventilating the hoods and the large still for furnishing distilled water are also located here.

Equipment. The department is well equipped with all the necessary apparatus for carrying on not only the elementary work in chemistry, but advanced and research work as well. The general chemical apparatus is loaned and no charge is made if it is returned in good order. The laboratories are supplied with all the modern conveniences, and each student has his own locker in which he keeps his apparatus. The storage battery room is connected with the various laboratories so that the current can be utilized wherever needed.

THE COURSE in Chemical Engineering differs from the ordinary course in chemistry in that it is extended greatly along engineering lines. The manufacturer must not only understand the chemical reactions involved in a process; he must be able to devise machinery for the carrying out of these reactions on a large scale. Consequently a knowledge of mechanical engineering and to some extent of electrical engineering is demanded in these industries.

CHEMISTRY LABORATORY—CHEMICAL ENGINEERING

Following the elementary chemistry of the first year, the student continues the general subject in the second with a lecture course on advanced general chemistry and a lecture and laboratory course on quantitative analysis. There is also a course in chemical problems for the first two terms. In the third year organic chemistry is taken up in the class room and laboratory. This is, however, optional after the first term. In this year there is some elective work to be chosen from preparation of pure inorganic compounds, metallurgy, sanitary analysis, advanced quantitative analysis, and the reading of German chemical literature. In the fourth year come courses in industrial and physical chemistry during the first two terms, and technical analysis in the third.

The course is very strong along mechanical lines. In the third year, besides the three terms of mechanics, there is a course in technical drawing running through the year. This course deals especially with chemical machinery and leads up to a year's work in machine design during the fourth year. There is also a one-term course in power plants in the third year, and four weeks of carpentry and forge shopwork during the first summer.

In the second year a lecture course in mineralogy is given, followed in the third year by a course in fuels and general metallurgy. The student may also select further work in metallurgy including assaying if he so desires. In the fourth year a brief course in electrical machinery is given, including both lecture and laboratory work.

In addition to the elective work offered in the fourth year, three hours during the second and third terms must be devoted by the student to the preparation of a thesis. This includes a somewhat extended study of some chemical topic and embodies both library and laboratory work.

CIVIL ENGINEERING

(See Part I for more detailed statements.)

Among the special fields which are usually included under the title of civil engineering, are those of the design, construction, and maintenance of bridges, railroads, municipal water supply, sewers, street paving, road building and other public works, irrigation projects, and river and harbor improvements. The civil engineer also superintends topographic and geodetic surveys, and does other special lines of work.

The course of instruction is designed to provide the foundation upon which all of these specialties are built.

Quarters and Equipment. The department occupies the eastern half of Brown Hall. For drafting, three spacious and well-lighted drawing rooms are provided for the work of the second, third, and fourth-year students, respectively. In each room is a collection of working drawings, prints, maps, etc., gathered from practicing engineers, and arranged in suitable file-cases for ready consultation by the student. A large blue-print room on the ground floor is equipped with electrical blue-print apparatus, in addition to the ordinary sunlight frames.

For field work the instruments are one theodolite, eighteen transists fitted for various kinds of surveying, thirteen leveling instruments, plane table, solar compass, solar attachments, high-grade aneroid barometers, drainage levels, surveying camera, rods, chains, tapes, hand-levels, etc. Two current meters with accessories, and a rating course 175 feet long in the rear of the building furnish facilities for carrying on hydrograhic work.

SUMMER CAMP IN THE YELLOWSTONE

The cement-testing laboratory is fitted with necessary appliances for making the ordinary tests. It contains a Fairbanks tensile testing machine, briquette molds, sieves, apparatus for making hot tests, etc., and machine for testing plane and reinforced concrete beams.

The department also owns a complete outfit for carrying on the work of summer surveying in camp. (See page 4.) Summer camp in 1903 was held in the mountains of southeastern Kentucky, where surveys were made for an Indianapolis syndicate. In 1905 the students made surveys for the National government in Yellowstone Park. In 1906 and 1907 camp was pitched at Willoughby, Ohio, where surveys were made for the city and for the Cleveland, Painesville and Eastern Electric Railroad. In 1908 the camp was divided. The sophomores surveyed, mapped, and subdivided a 1008-acre tract at Mentor on Lake Erie, and the juniors surveyed and mapped topographically Fort Ancient, in Warren county, for the Ohio Archæological and Historical Society.

THE COURSE. The technical work begins in the second year with courses in land and railroad surveying, accompanied by practice in the field, and by class room work in topographic drawing, and streotomy. In the third year are courses in topographic surveying, a drawing room course in timber construction, a lecture and laboratory course in cement testing, and class room courses in roads and streets, bridge stresses, and sanitary engineering. In the fourth year are given courses in bridge design, masonry structures, and reinforced concrete; also class room courses in masonry construction, water supply engineering and contracts and specifications. There is also an opportunity to select between a course in advanced bridge designing and one in railway location. The practice in free-

CIVIL ENGINEERING STUDENTS

hand drawing given in the machine sketching of other courses is here obtained in topographic drawing.

Distributed through the third and fourth years are also given courses in the applications of electrical machinery, least squares, differential equations, astromony, photography, water pumps and motors, testing of materials of construction, calibration of weirs, economic mineralogy, and general geology. Most of these courses include laboratory practice. In each of the summers following the second and third years, four weeks of field practice in surveying is required, and before graduation, a thesis giving results of some original work along civil engineering lines.

WORK OF GRADUATES. The demand for the well trained civil engineer has become very great, and he may serve in many fields in public, corporate, or private capacity. Among those who have studied civil engineering here may be found some serving in each of the War, Navy, and Interior departments of our National Government. One of the graduates is State Highway Commissioner, and one Chief Engineer of Public Works in his state. There are many who are engineers for the counties or cities in which they live. More still are employed by corporations. The railroads call for many in the work of location and construction, or in the maintenance of way department after the road is built. Steel construction in bridges, tall buildings, and other special structures occupies the time and talents of many, while the rapid adoption of reinforced concrete has opened still another door to the structural engineer. In private capacity the others are occupied in sanitary, hydraulic, and many other special branches.

ELECTRICAL ENGINEERING

(See Part I for more detailed statements.)

While there are few industries into which the application of electricity does not enter, there are several, such as electric railways, lighting and power, telephony and telegraphy, railroad signaling, shop drive, etc., and the manufacture of the corresponding forms of apparatus which call especially for an electro-technical training.

QUARTERS AND EQUIPMENT. This department is located in the north end of the Engineering Laboratory. See page 7. It has one large dynamo laboratory, 90x112 feet, and seventeen smaller rooms. There are also two long balconies used for drafting and computation.

Among the smaller rooms the following may be especially noted. The calibration room is well and conveniently fitted up with standards. These are kept accurate by frequent comparison at the National Bureau of Standards and are at the service of the electrical industries of the state.

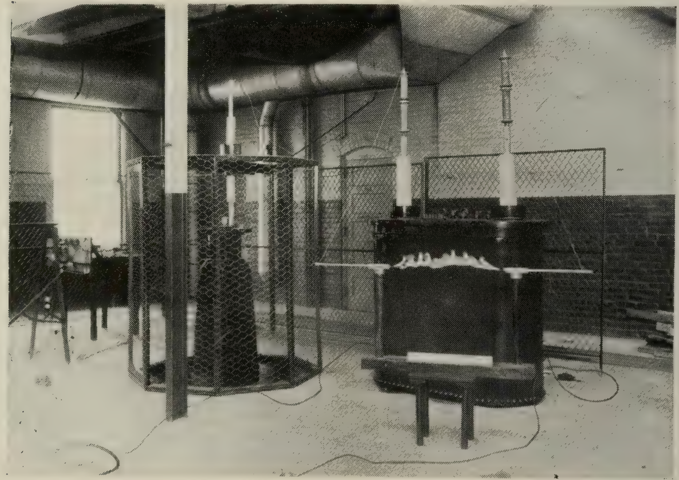
Two telephone laboratories are separated by a sound-proof partition. They are well equipped with apparatus of different makes, including a set of Western Electric switchboard apparatus. There is also an artificial 100-mile line, comparison apparatus, etc. Wireless telegraphy has just been introduced and a wireless station capable of distant transmission will be installed within a few months.

The illumination laboratory is fitted for working with light or dark walls; there is a good photometric outfit and an illuminometer. The cable and iron testing laboratory is used for such work as requires galvanometers and other delicate apparatus. The battery room contains a 200-ampere-hour storage battery, with end-cell switching arrangements, etc. There are two small shops fitted up for the construction and repair of apparatus by the department machinist. The necessary recitation rooms, offices, etc., are provided, and a museum with a collection of material illustrating applied electricity.

On the main floor is a space screened off for high potential work, where a 250,000 volt, 50 kilowatt transformer forms a part of the equipment. Provision has been made for apparatus suitable for running and testing in the laboratory a complete interurban car. The dynamo equipment of forty generators and motors both alternating and direct current aggregates over 400 horsepower capacity, and includes all important commercial types. A liberal equipment of measuring instruments of various kinds is available, including potentiometer, oscillograph, tachometers, frequency meters, etc.

THE COURSE. Electricity and magnetism naturally constitute the most important studies of this course. This work begins in the second years in the physics department; in the third year it occupies nearly half of the time, and includes electrical measurements in the first and second terms, direct current dynamo-machinery in the second and third terms, and alternating current apparatus in the third. In all of this work the laboratory plays an important part. In the fourth year the study of alternating current apparatus in class room and dynamo laboratory runs throughout the three terms. The design of dynamo machines comes in the second and third terms. Short courses are also given in electrical applications, transmission, railways, telephones, illumination, and wireless telegraphy.

Besides the work of the first and second years, practice in drawing is obtained in the design work of the third and fourth years. Work in carpentry, forging, chipping and filing, and the machine shop occupies four weeks of continuous time in the first summer and continues during three terms of the second and third years. The successful electrical engineer must be a good mechanical engineer. Thus, courses in mechanism, mechanical laboratory, power plants, engines and boilers, and machine design are distributed over the last two years. There are also some electives in the second and fourth years.



250,000 VOLT TRANSFORMER AND ELECTROSTATIC VOLTMETER

An important feature is the two inspection trips which are required in the junior and senior years, and which include the cities of Pittsburg, Buffalo, Niagara and Cleveland, and of Chicago, Milwaukee, and Ft. Wayne. These trips occupy six days each and are of great value to the students.

ARTISAN COURSE. See also page 17. During the first four weeks of the summer term four artisan courses are given, covering elementary electricity and magnetism as applied in practical work, direct current dynamo machinery, the elements of alternating currents, and lighting and illumination. These courses are given in the dynamo laboratory by the instructors of the department, and the equipment is all available for the work, which is made as simple and as practical as possible.

Work of Graduates. The large electrical manufacturing companies employ many. Among the positions in such companies now held may be mentioned, chief engineer, consulting engineer, heads of departments, engineers in charge of installation work, designing and special engineers; sales managers, district sales managers, general sales agents, district salesmen, etc. Others hold positions with smaller companies such as president, vice president, manager, assistant superintendent, etc. In telephone work several are engineers with manufacturing companies; others act as chief engineers and installing engineers, with construction companies; in the operating end such positions as general manager, chief inspector, superintendent of equipment, department supervising engineer, and designing and constructing engineer are held. With lighting, power and railway companies such positions as general manager, manager, general superintendent, superintendent, assistant superintendent, chief engineer, electrician, and designing and constructing engineers may be mentioned.

The electrical supply business appeals to some, and such positions as president, secretary and treasurer, manager, department manager, purchasing agent, etc., are held with these companies. Some go into educational work as instructors of electrical engineering, physics, and mechanical engineering. Some are engineers in railway signaling, both manufacturing and operating. Others that may be named are engineers with automobile companies, a coal and coke company, a carbon manufacturing company, a cash register company, an incandescent lamp company, an insulation manufacturing company, U. S. War Department, etc. Other positions held are an assistant in the National Bureau of Standards, an editor of an electrical journal, a patent attorney and a patent engineer. Some are consulting electrical engineers and others their assistants. Some get into various mechanical pursuits.

INDUSTRIAL ARTS

(See Part I for more detailed statements.)

This department has charge of all the shopwork given in the various courses. It occupies the greater part of Hayes Hall and comprises shops for giving instruction in wood work, forging, machine work and foundry.

The courses in shopwork are intended primarily to give the engineering student such familiarity with tools and shop methods as will be essential to his success in designing and in the various duties which his work as an engineer will require him to perform. A high degree of accuracy in this work is required rather than great speed. The latter can usually be attained only through more extended practice than can properly be given in an engineering course. At the beginning the student is introduced to forms of shopwork where the machine element is absent, such as carpentry, forging, and chipping and filing. Later foundry and then machine work in metals and such turning of wood as pertains to pattern making are taken up. It is the policy of the department to make useful articles as practice pieces to the greatest extent compatible with a proper progression in the degree of skill required.

EQUIPMENT. The carpenter and pattern shop is fitted with well designed benches and a complete set of carpenter tools is contained in the drawer and cupboard of each bench. There are also wood turning lathes including an eight-foot pattern-maker lathe. Among the power tools, planers of different kinds, and circular, scroll and band saws may be mentioned. In the forge shop besides the usual forges and anvils with the accompanying hand tools, there are a number of special tools. Among these are a special gas furnace, foot power hammer, drill, and a combined punch, shear, and bar cutter. The foundry has a twenty-four-inch Colliau cupola; there are also brass furnaces and a core oven. In the machine shop besides the benches and tools for vice work and a good equipment of lathes of various types there may be mentioned a monitor turret lathe, planers, shapers, milling machines, grinding machines, and arbor presses. There is also a full equipment of small tools, including a great variety of special ones.

THE COURSE. The department offers a four-year course in Industrial Arts designed especially to train men for positions, as business managers, shop organizers, superintendents, foremen, and salesmen in connection with various branches of manufacture.

To this end the emphasis is laid upon shopwork, economics, and various aspects of factory design, equipment, and management. Each of these lines of work is continued through the three upper years of the course. The shopwork includes founding, pattern making, chipping and filing, forging and machine work, and is very thorough. Machine work in particular is carried through five terms. Economics begins with a course on the elements of political economy running through the third year, and includes also courses on industrial and social history of the United States, commercial and economic geography, accounting and statistics, industrial organizations, corporation finances and organization, labor organizations and employes associations. The work in factory design and equipment begins in the third year with a study course on the principles of construction of machinery, running through the year. This is accompanied during part of the year by a course in design, applying the principles of motion to certain practical problems. In the fourth year the work is continued with courses on shop construction, equipment, and management, accompanied by corresponding work in design.

Courses are also given on metallurgy of fuels and iron, timber and masonry, power plants, dynamo machinery, use of surveying instruments, steam engines and boilers, materials of construction and power transmission. In most of these courses laboratory work forms an important part.

MACHINE SHOP—INDUSTRIAL ARTS

MANUAL TRAINING. A course in manual training is also temporarily given in this department.

SUMMER SHOPWORK is required in some of the engineering courses, and is given in the first four weeks of the summer term.

THE TWO-YEAR OR SHORT COURSE in Industrial Arts is intended especially for workers in the shops or drafting room. It gives besides the common subjects indicated on page 17, work in pattern making, forging, foundry, chipping and filing, and machine shop to the extent of a little more than one-third of a year's work. Besides this there is additional mechanical and freehand drawing and descriptive geometry; also study and practice in designing of the movements used in different machines.

The Artisan Course. (See page 17.) During the second four weeks of the summer term the shops and tools of this department are devoted to the use of the artisan students, and shop courses are given in the following subjects: Pattern and cabinet making, forging, tool-smithing, bench work in iron, metal lathe work, advanced metal lathe work, milling and grinding, and tool making. The work in these courses is given eight hours a day for six days each week. In these the plan is followed of adapting the work of each man to his own needs and desires, taking into account what he has already done before beginning the course. It gives a good opportunity to those who have been kept on only one or two machines to learn about the working and use of other machines and to become all-round mechanics. Instruction is first given on a piece of work, embodying what is to be done, how to do it, and why that method is used, and then the actual operations are performed by the student. In this way a knowledge is acquired in a short time that would be but slowly attained in a factory. The instructors are all practical and experienced men in this work and in teaching.

MECHANICAL ENGINEERING

(See Part I for more detailed statements.)

Mechanical engineering in its broadest meaning includes the invention, development, design, manufacture, and operation of all forms of machinery. The lines of work for which the course specially prepares are numerous. The development and testing of all forms of machinery in their mechanical and manufacturing aspects employs many. This is particularly true of those forms of apparatus that have to do with the convertion of energy from one form into another, such as boilers, steam and gas engines, water wheels, windmills, pumps, and other prime movers. Power transmission machinery; the construction, operation and management of power plants, the motive power equipment of railroads; the design of heating, ventilating, and refrigerating plants; and the manufacture of the products of rolling mills, cotton, woolen, and flour mills all have need for the mechanical engineer. Again, commercial work of all kinds, connected with shops and factories using machinery, and the salesmanship of engineering supplies and machinery offer an ever increasing field. All this work leads in turn, by gradual promotion, to the higher executive positions of the industrial world, for which the graduates of the engineering courses are now in much demand.

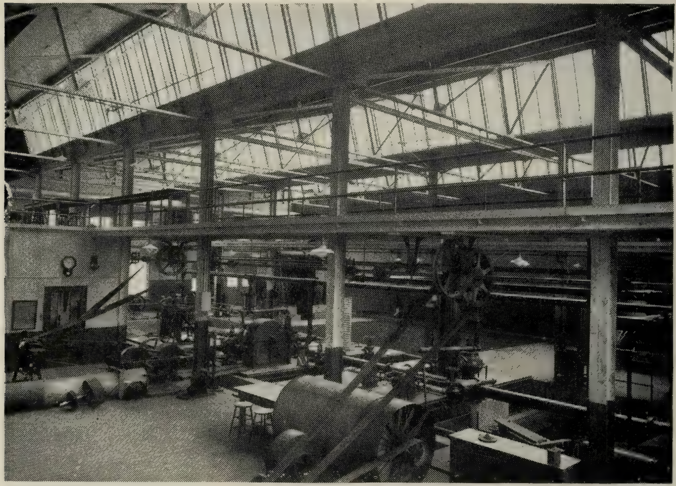
Building. The Department of Mechanical Engineering occupies the south end of the Engineering Laboratory. See page 7. The main laboratory is 90 feet by 112 feet, and is divided into three sections. The steam engineering section contains three 35-horsepower, horizonal, plain and automatic-cutoff engines; one 50-horsepower tandem, compound, vertical engine, with riding cutoffs and link motions; one 250-horsepower, cross-compound, vertical engine, with reheater, all provided with surface condensers, air and circulating pumps for measuring the steam consumption and for working condensers. The hydraulic section is equipped with eleven cisterns, a flume having a cross-section of thirteen square feet, submerged orifices up to thirty inches in diameter, a 30-foot well, and weirs capable of measuring up to 16,000 gallons per minute. It is provided with simple, compound, triplex, centrifugal, and rotary pumps, pulsometer, turbine and impulse water-wheels, and a variety of apparatus specially adapted to study the flow of liquids. The southern section contains Riehle and Olsen testing machines for materials in tension, compression, bending, shear, and torsion; dynamometers for measuring the power supplied to machines; and the departmental machine shop. Supported by the columns carrying the sawtooth roof, and between the sections are two galleries, each 8 feet by 108 feet. One of them is used as a drawing room; the other is used to study the flow of steam, air and water through pipes and bends.

Next to the steam laboratory is a section, 48 feet by 144 feet, adapted for the testing of boilers and gas-power machinery. It is equipped with a horizontal, internally-fired, tubular boiler, a locomotive boiler, and a 107-horsepower Babcock and Wilcox water-tube boiler, provided with both an automatic stoker and a flat, shaking grate, with forced, induced, and chimney drafts, and a complete equipment of testing appliances. The gas-power section has one oil and three gas engines, with complete facilities for measuring the fuels, air, and water which are used and the power developed.

Between the boiler room and the electrical engineering laboratory is the demonstration amphitheatre. In this section is the laboratory which has been used for automobile testing work, and is intended to be completely equipped for the testing of locomotives and automobiles. This will soon be connected with the tracks of the Hocking Valley Railroad by a private switch.

The two-story portion at the south end of the building is used for offices, three class rooms, an engineering museum, locker rooms, oil testing laboratory, photographic dark room, and instrument room.

THE COURSE. Apart from the advanced drawing and shopwork, the technical work in mechanical engineering begins in the third year with two terms of lectures, recitations and practice in the principles of mechanism and mechanical movements. Work in steam engineering begins in the third term with a descriptive course on power plants. In the fourth year the steam engineering work is continued with courses on engines and boilers and thermodynamics. A laboratory course runs throughout the year, and covers the testing of materials of construction, steam, hot-air and gas engines, power transmission, boilers and injectors, air compressors, pumps and other hydraulic apparatus. The course in machine design runs through the year with lectures, recitations, and drawing-room practice in the applications. Brief courses on hydraulic machinery, and upon shop appliances and steam turbines, complete the list of mechanical engineering subjects.



MECHANICAL ENGINEERING LABORATORY

Training in the different kinds of shopwork begins in the first summer and extends into the third year. It includes wood-shop, pattern-making, chipping and filing, forge-shop, foundry and machine-shop work.

In addition to these, allied courses are given in the chemistry of fuels, the metallurgy of iron and steel, in timber and masonry constructions, the design of trusses, in differential equations, dynamo machinery, and photography. In the last two subjects, laboratory work plays an important part.

Two inspection trips of six days each, one during the third and one during the fourth year, to Pittsburg, Buffalo, Niagara Falls, and Cleveland, and to Chicago, Milwaukee, and Ft. Wayne, form parts of the regular work. A thesis, giving the results of a piece of original work, is required before graduation.

Artisan Course. Besides the regular work of the four-year course, described above, a series of courses for aristans are given by the Mechanical Engineering Department in the summer term. These courses deal with steam and gas engines and boilers. There are two daily lecture courses, one dealing with steam and gas engines, treating them from the point of view of the operating engineer, and the other with steam boilers, including the information that the fireman or stationary engineer should possess. The other two courses each comprises four hours daily in the laboratory, and are intended to accompany and enforce the two lecture courses given above. The work in these two courses includes the testing of steam engines and gas engines, taking indicator diagrams, measuring indicated brake horsepower, steam and gas consumption; the testing of steam boilers for boiler horsepower, water evaporated, and fuel consumed; the use of injectors and feed pumps, and their economical management.

MINE ENGINEERING

(See Part I for more detailed statements.)

The profession of mine engineering, which has for its main object the development and winning of mineral resources, is closely connected with that of metallurgy. This latter deals with the treatment of ores in order to extract their valuable metals and the purification and preparation of fuels to adapt them to commercial use. The course in mine engineering, therefore, must comprise both of these lines of work together with the sciences, such as geology and chemistry, which are of the most direct importance to the mining and testing of mineral deposits. Coal mining, being the most extensive of all the mining industries, must occupy a large portion of the time, just as on the metallurgical side the smelting, treatment, and manipulation of iron and steel are of the first importance.

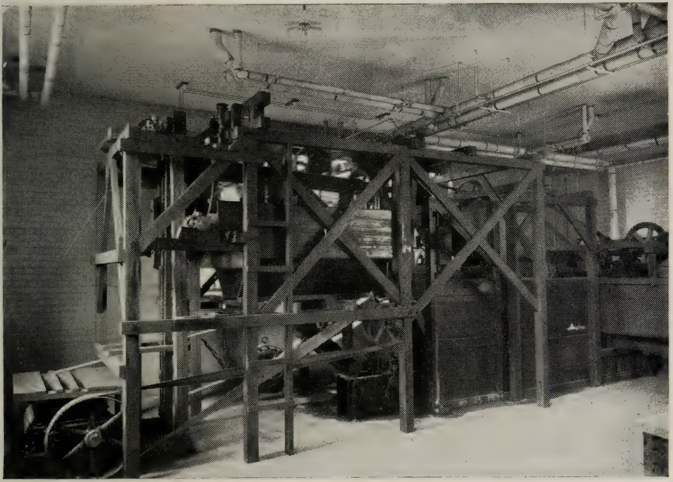
Quarters. The department occupies the east end of the second floor of the School of Mines Building and one basement room, and has a floor space of 6000 square feet. This includes the office of the department, a large lecture room, a drawing room with accommodations for fifty students, a blue-print room with full equipment for both sun and electric light printing, a laboratory for safety lamp testing and other special work, and in the basement a large room for work in ventilation.

EQUIPMENT. This includes all of the latest improved instruments and apparatus used in mine surveying and mine ventilation. There are a variety of surveying instruments for general practice, also targets, plummet lamps, etc., for mine and tunnel work. The laboratory contains apparatus for the testing and an outfit for the repair of safety lamps; and practice tests are made with the lamps for the detection and estimation of fire damp. An outfit for special analytical chemical and mineralogical work is also available for use at all times. A large assortment of models of mines, coal tipples, metal head frames, split construction and the various types of framing are used in conneection with the lectures and are kept in the museum for the use of the students. For the practical study of ventilation the equipment is very complete, and includes anemometers, water gauges, barometers, barographs, polymeters, registers, etc., most of which are self-recording; there

MODEL OF TIPPLE—MINE ENGINEERING

are also a portable gas apparatus, and various forms of rescue apparatus.

THE COURSES. The special work in mine engineering proper begins with mine surveying, in which, in addition to the instruction at the University, practice is given in actual surveying of coal mines accessible to Columbus. This work comes in the third year of the course. In the fourth year a course of lectures, covering three terms, treats of the problems of mine engineering involved in opening, developing and equipping mining plants, and the prospecting, location, and examination of mineral property. This lecture course is supplemented by work in a drawing room where actual problems are worked out.



COAL WASHER—DEPARTMENT OF METALLURGY

In the last term of the fourth year a course is given in plans and specifications for mining plants.

The special work in metallurgy begins in the winter term of the second year and comprises in that year two terms' work in metallurgical laboratory covering the technical analysis of ores, metals, and fuels, and one term in mineralogy and crystallography. In the third year a course of lectures for two terms, treats of the principles of combustion, the valuation and the treatment of fuels and the extraction and preparation of iron, steel, and other metals, including gold and silver. There is also work in advanced metallurgical laboratory, where special analytical methods, coal washing and ore dressing are studied by lectures and laboratory practice, also calorimetry and the microscopic examination of metals. In this year there is a one-term course in determinative mineralogy and a one-term laboratory course in the fire assaying of gold, silver, and other ores.

In the fourth year there is a course in connection with the department of mine engineering on metallurgical construction covering the design of furnaces and other metallurgical machinery, and a course of lectures on ore dressing and coal washing. In the department of metallurgy there is opportunity for the study of mine gases, their effects, and determination.

There are also courses in woodwork and forging and in photography, general and economic geology, and petrography, engines and boilers and electrical machinery with lectures and laboratory; there is also a recitation course on truss design. Before graduation a short thesis giving the results of original work connected with mining or metallurgy is required.

THE SHORT COURSE in mine engineering gives practical instruction of a more elementary character in mine engineering, ventilation, drainage, haulage and other problems of mine operation, particularly as applied to coal mining. It also includes work in physical geography, elementary geology, inorganic and mineral chemistry, the latter covering work relating to mine gases, explosions, and water supply.

WORK OF GRADUATES. To give an idea of the kind of positions held by the graduates from this course, the following classification of positions now held by men who have been out three or more years is given.

Managers and superintendents of plants, 16; mine engineers in metal mining, 11; mining engineers in coal mining, 21; metallurgists and chemists, 14; manufacturers of mining machinery, 4; general and consulting engineers, 7; teaching in universities and mining schools, 4; miscellaneous, 11.

METALLURGY AND MINERALOGY.

The equipment of this department is unusually complete. It occupies about 14,000 square feet of floor space at the east end of the basement and first floor of the School of Mines Building, which was recently built and equipped at a cost of $110,000. In addition to the lecture rooms, there are separate laboratories for the following lines of work: For the analysis and assaying of iron, steel, ores, and furnace products by wet methods; for fire assaying and testing of gold and silver ores equipped with furnaces and cyanide plant; for general and determinative mineralogy equipped for blowpipe analysis and for the microscopic examination of minerals; for the calorimetric examination of coals and other fuels, technical gas analysis and the examination of mine air; for the microscopic examination and thermo tests of metals; and for the analysis and complete examination of coals. There is also a crushing and sampling plant for experimental tests on ores and minerals. The department now has a complete model New Century coal jig, a small experimental ore jig, and other apparatus for the practical testing of coal and ores by washing methods. The museum contains a large number of specimens and is being rapidly developed.

ENGINEERING DRAWING

The great importance of drawing both freehand and instrumental as tools for the use of the engineer gives especial emphasis to the work of this department, where are given all those courses which are associated with the engineering college work.

The headquarters of the department are in Brown Hall where in four large, well-lighted drawing rooms the work in mechanical drawing is given. These rooms are suitably equipped with drawing tables and lockers. There is a case of models for use in descriptive geometry; also special drawing devices and instruments and a collection of shop drawings, illustrating modern drafting room equipment and methods. For the work in blue printing as given in these courses, two special rooms are available, one fitted with an arc lamp printing machine, the other with sun frames.

The courses given include, beside the elementary work in the use of instruments and lettering, all the projection drawing and descriptive geometry and various courses in technical drawing, machine sketching, drafting, and blue printing adapted to the work of the several departments.

The work in freehand drawing is given in Hayes Hall where a fine collection of models and castings is available, together with the necessary equipment of modeling tools and other apparatus for clay modeling and plaster casting. Here besides the elementary freehand drawing, courses in pen drawing, charcoal drawing, water color painting, and clay modeling are given.

Artisan Courses. During the first four weeks of the summer term two special courses are given for the benefit of artisan students, one in elementary and the other in advanced mechanical drawing. The former is a beginning course while the latter is designed for men who have had some experience. These courses are carried out with special reference to the needs of those who take them. There are also a number of regular University courses, including projection drawing, descriptive geometry, drawings for teachers, and lettering in design, which run through the whole eight weeks of the summer term and are open to any who have the necessary preparation.

ENGINEERING DRAWING

MECHANICS

The work in mechanics is given chiefly by recitations with occasional lectures illustrated by experiments. The aim of the course is to give a thorough foundation in the principles of the subject, and to connect the mathematics and physics which the student has previously studied with the engineering problems of the latter part of his course. As a step in the accomplishment of these purposes he is required to solve a large number of problems involving the principles of mechanics and requiring for their solution the use of all his mathematics from arithmetic to calculus. These problems include a sufficient number of engineering applications to stimulate his interest and get him well started in this work, but care is taken that elementary principles be not lost in a multiplicity of technical details which may better be studied later.

The first term is given to statics, including the statics of three dimensions, flexible cords, and friction. Graphic and algebraic methods are taught together and applied to simple trusses and like problems. The mechanics of materials is given in the second term. The third term is given to the kinetics of solids and liquids. It includes the flow of liquids through orifices and weirs, the Venturi meter, the Pitot tube and the loss of head due to friction.

ASTRONOMY

Astronomy is of great importance to the civil engineer in connection with geodetic survey work, the determination of longitude and latitude, and its methods are instructive in connection with the determination of the probable error of observation.

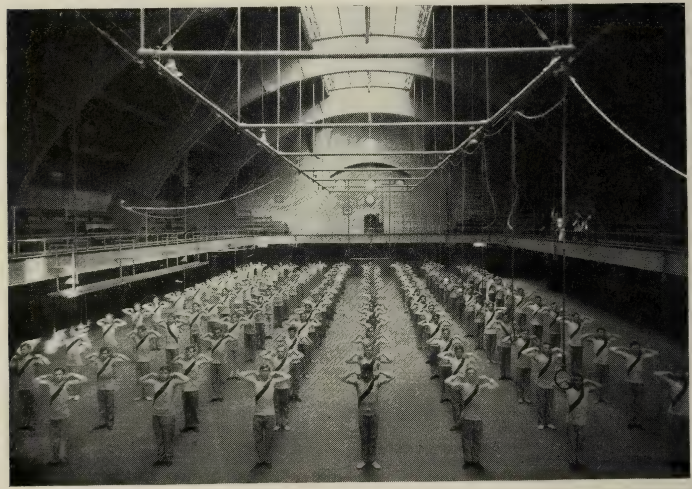
The Observatory was founded in 1895, through the generosity of Emerson McMillin. This building comprises, besides the main dome, the library, lecture room, computing room, and photographic dark room, comparator room, instrument shop, spectroscopic laboratory, zenith telescope and transit room, and a theodolite house. The equipment includes a twelve and one-half-inch equatorial telescope. This is fitted with a powerful spectroscope equipped for a large variety of work, both visual and photographic. There is also a two and one-half-inch zenith telescope, and three-inch transit instrument, a twelve-inch theodolite, and two five-inch theodolites, a sideral clock, a filar micrometer, four-inch portable equatorial telescope, chronograph, sextants, chronometers and other instruments. The University is a volunteer meterological station of the United States Weather Bureau and the daily observations are taken upon instruments located at the Observatory. The equipment for spectroscope work is unusually complete and much valuable investigation along this line has been carried out. There is also a fine equipment of machine and other tools for instrument making, with gas engine, generators, storage battery, etc.

GEOLOGY

Geology forms an important study in those branches of engineering such as mining, ceramic and civil engineering, which have laregly to deal with earth's surface. This department is located in Orton Hall (see page 8), and is noted for its fine museum of geological material. As the collections of the State Geological Survey are permanently located here, the material illustrative of Ohio formations is particularly complete. It is interesting in this connection to know that in the construction of the building a great variety of material contributed from various quarries of Ohio was used. Thus the building itself, forms an important part of the geological collections. Good opportunities are provided for the work in the lithological, stratigraphical, and physiographic laboratories.

MILITARY SCIENCE AND TACTICS

In accordance with an Act of Congress all students, unless excused, are required to drill during two years. This work is under an officer of the regular army detailed for the purpose. Besides drill, the study of military tactics and art of war, practice in shooting, etc., is included, and an opportunity to serve in the cadet band is offered.



CLASS IN GYMNASIUM

PHYSICAL EDUCATION

The University recognizes the need for the physical as well as the mental development of the students and provides the necessary means in a finely equipped gymnasium, the main floor of which is 80 by 150 feet. There is also a smaller gymnasium room, locker room, shower and swimming baths. This work is done under a director who is a graduate physician and a member of the faculty. Two hours per week in the gymnasium are required from all students during the first year.

PHYSICS

This science, upon the principles of which so much of the work of all classes of engineers is based, is well housed in the Physics Building. (See page 8.) A lecture room, capable of seating 250 students, and with fine equipment, is used for the lectures of the second year. This course also includes recitations and laboratory work. The equipment for the latter permits each student to perform the experiments illustrating the work covered in class. For the special laboratory work in machanics and heat the equipment is good, including apparatus for showing the composition of forces, acceleration of gravity, balances, chronometers, chronographs, cathetometers, calorimeters, and various other forms of heat apparatus. In electricity and magnetism, upon which the work of the electrical engineering course so largely depends, the equipment is unusually complete, including, besides the necessary galvanometers, resistance boxes, voltmeters, ammeters, wattmeters, etc., many special instruments such as oscillographs, potentiometers, photometric apparatus and watt-hour meters. The laboratories for this work are located in the basement and are liberally provided with slate-capped brick piers and wall brackets which give excellent conditions for the use of galvanometers. The laboratories are thoroughly wired, and a large storage battery as well as a motor generator set and mercury vapor converter furnish current.

ENROLLMENT*

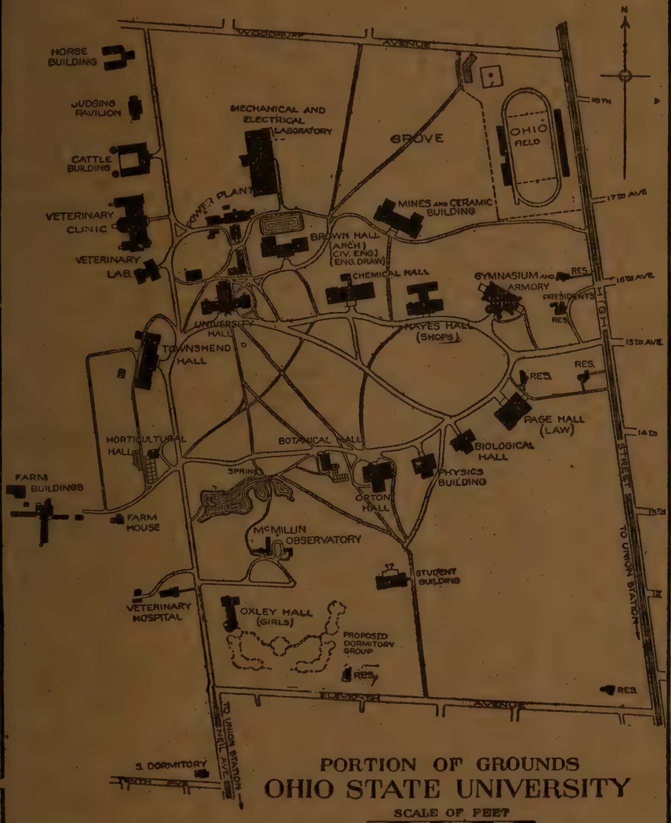
March 25, 1909

STUDENTS IN FOUR-YEAR COURSES LEADING TO DERGEES	864
STUDENTS IN SHORT COURSES NOT LEADING TO DEGREES	46
SPECIAL STUDENTS	33
TOTAL	943

CLASSIFICATION BY COURSES

Name of Course Pursued	4th year	3d year	2d year	1st year	2d yr. short	1st yr. short	Special	Total
Unclassified	....	....	....	295	....	....	....	295
Architecture	6	5	18	Unclassified	....	....	....	29
Ceramic Engineering	21	17	27		8	9	....	82
Chemical Engineering	10	6	17		....	....	....	33
Civil Engineering	38	43	69		....	....	....	150
Electrical Engineering	27	40	62		....	....	....	129
Industrial Arts	1	....	1		3	8	....	13
Mechanical Engineering	22	36	43		....	....	....	101
Mine Engineering	16	16	28		7	11	....	78
Special, Unclassified	....	....	....		....	....	33	33
Total	141	163	293	295	18	28	33	943

*For list of names consult the General Catalogue of the University, which will be sent on application.



PORTION OF GROUNDS
OHIO STATE UNIVERSITY
SCALE OF FEET
1909

The Ohio State University Bulletin is issued at least fifteen times during the Academic year, monthly in October, November, and June, and bi-weekly in December, January, February, March, April, and May.

M.8.R-

UNIVERSITY OF ILLINOIS-URBANA
3 0112 112242182